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VOL. XVIII NO. 4

SOCIETY FOR ADVANCEMENT OF MANAGEMENT
The Pioneer in Management Philosophy

UNIVERSITY of PENNSYLVANIA—THE WHARTON SCHOOL

4th ANNUAL REFRESHER CONFERENCE

Work Simplification and Measurement in the Office and Factory

June 22 - July 3, 1953 and One Week Pre-Conference Session on Basic Tools and Techniques June 15-19, 1953

★ **RECENT DEVELOPMENTS IN METHODS AND TECHNIQUES** ★ **PROBLEMS OF OBTAINING EMPLOYEE ACCEPTANCE**

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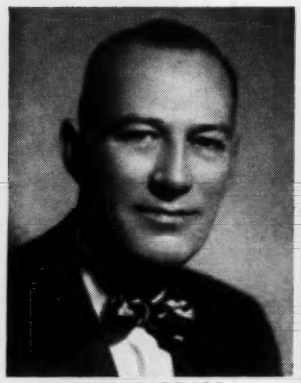

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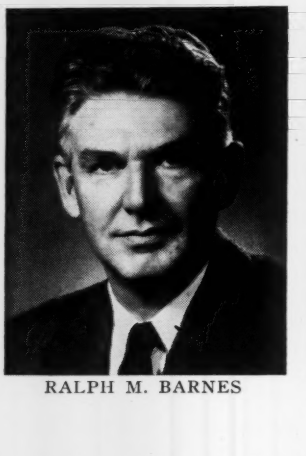

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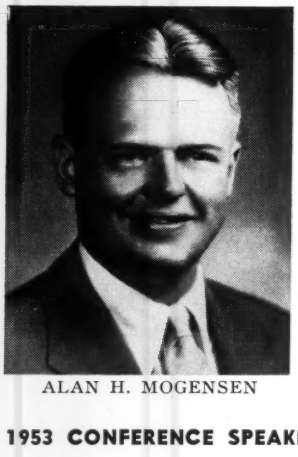

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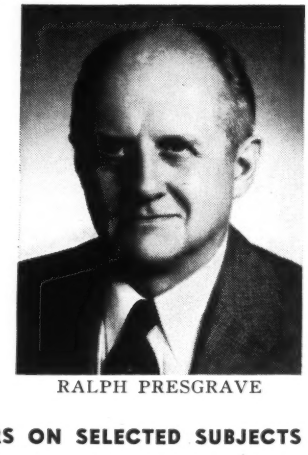

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For the use of library facilities, materials and supplies, notebook, special material, laboratory equipment, and the services of the staff, a fee of $250.00 is charged for the regular 2-week conference. A fee of $125.00 is charged for the one-week basic conference. Reservations are on a first come, first served basis.

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Meals and lodging will be furnished at actual cost. Accommodations will be in fraternity houses with single rooms wherever possible. All communications should be addressed to V. DONALD SCHOELLER, Conference Director, W160 Dietrich Hall, University of Pennsylvania, Philadelphia 4, Pa.

All Sessions to be held in the Newly Constructed and Air-Conditioned FREDERICK WINSLOW TAYLOR MANAGEMENT LABORATORY

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SAM and The Industrial Engineer

Edward W. Jochim
President, SAM,
1952-53

THIS ISSUE of ADVANCED MANAGEMENT is devoted to the industrial engineer and his place in American industry. Through the years the industrial engineer has become an increasingly important member of the management team. And because of the increased importance of his work, the Society holds it's Annual Industrial Engineering Conference.

The industrial engineer is a relatively new breed of engineer. He's a specialist without boundaries. He's a specialist, but not limited to one field. He's the product of fertile minds of men like Taylor, Gilbreth, Gantt and others.

He's not a mechanical engineer, but he knows what the mechanical engineer does. He's not an electrical engineer, but he understands electricity and power distribution. He's not a civil engineer, but he knows how to lay out an efficient manufacturing plant. The industrial engineer is a little bit of all engineers rolled into one.

To many people the industrial engineer is interested only in the manufacturing industries. This field has, in the past, been of vital interest to him. It will continue to be in the future. But the industrial engineer is *also* interested in the functions of retail merchandising, distribution, office work, institution management and many others. It is toward these other fields that the industrial engineer in the future will be turning more and more of his attention.

HAS MANAGEMENT USED HIM PROPERLY?

Has management put the industrial engineer to his best use? In some cases "yes." In many cases "no." In the minds of too many members of management, the industrial engineer is the plant "lackey"— the young man with the stop watch, the tape measure and the fourth decimal point. They fail to see how the stop watch, the tape measure and the fourth decimal point help management to find the best and cheapest way to produce the product at the lowest possible cost commensurate with quality.

Often it's the industrial engineer's stop watch and tape measure that keep management in business.

HAS THE INDUSTRIAL ENGINEER SOLD HIMSELF TO MANAGEMENT?

Again the answer is partially "yes" and partially "no." Because of his breadth of interest and activity about the plant, because of the magnitude of his intangible as well as tangible contributions to the success and well-being of the company, the industrial engineer is not always able to point to the ledger and say "This is what I saved you last week."

The industrial engineer knows the gains he has made for management. (And intelligent managements know, too.) Too often his sense of modesty, combined with his forward-looking rather than retrogressive thinking, deters him from stressing or dramatizing his value to management.

Today we find ourselves operating in an increasingly competitive market. As competition increases, the industrial engineer's opportunity to increase his value to management—and to all society—increase proportionately.

The time has come when the industrial engineer must be recognized for his true worth to industry.

The Society for Advancement of Management can *and is* providing a place where the values of the industrial engineer can be heard—be heard and passed on to management. It is helping both management and the industrial engineer see the rightful place of the industrial engineer in today's society.

In the Society's many chapters, located in the principle cities of the country, management men meet regularly to exchange the latest ideas about advancements in management, both theoretical and practical. Through annual conferences, such as the Industrial Engineering Conference this month, where more than 2,000 industrial engineers will gather, the Society is helping members and non-members alike do a better job—producing more for less.

This month the Society is working with the industrial engineer specifically, but all management in general, both in ADVANCED MANAGEMENT and in the coming conference. It is only through close cooperation of management and the industrial engineer that we can continue to do our job better—produce more of better quality for less. ★

An Analysis Of Work Decrement Factors In A Repetitive Industrial Operation

By LOUIS E. DAVIS and P. DUDLEY JOSSELYN

As a result of careful research, the authors suggest hypotheses concerning constant effective operation time.

THAT WORK decrement or fatigue results from physical activity and that it increases as the work period progresses are concepts that have long been accepted. Other than good measures and descriptions of the gross changes in productivity, little is known about the pattern, distribution and stability of rates of output, or of daily work habits under various environmental conditions (12, 13).

A study was organized to examine the effects of work decrement influences on productivity, or of what is nominally identified as fatigue, on work habits, work methods, work organization and on work rates. The broad purposes of the investigation were to determine what factors account for the decrement in output and for the continued decrease in productivity as the work period progresses which are considered typical of many types of industrial operations. A number of hypotheses suggest themselves to explain these phenomena. These are:

1. The operator continues to use the same work method and to work at the same rate of speed, but introduces more or longer rest periods or work stoppages.

2. The operator continues to use the same work method but works at a slower rate of speed by either:

   a. Slowing down all motion-elements of the operation uniformly,
   b. slowing down some motion-elements and not others, and
   c. slowing down all motion-elements, some more than others.

3. The operator changes his work method to another requiring a longer time to perform, by:

   a. Substituting motion-elements that require more time to perform because they use different muscle groups, travel longer distances, are less skillfully performed, etc.,
   b. inserting unnecessary motion-elements.

HIGHLIGHTS ON THE AUTHORS

Louis E. Davis (picture at left) is Assistant Professor of Mechanical Engineering, University of California. He has worked as an industrial engineer with outstanding companies and also taught at the University of Iowa and Georgia Tech.

P. Dudley Josselyn is an industrial engineer at Rheem Manufacturing Company.

Some definitions of terms as used here may be helpful. Productivity is defined as units of activity accomplished, or items completed, in a unit of time. Production or output is the total units of activity accomplished, or items completed, in a work period. Operation time is the time required to complete one item or accomplish one unit of activity. Effective operation time is defined as the time spent exclusively in carrying out the requirements for completing an item or unit of activity, excluding stoppages and delays. All nonproductive or non-working periods are listed as delays and classified as to cause or reason.

The specific purposes of the study performed to examine the factors that may account for the effects of fatigue or work decrement and to test the hypotheses indicated are:

1. In relation to production or output, to determine if there is a significant difference in operator's production per day of the week; and between morning and afternoon.

2. In relation to rate of work, to determine if there are significant changes in operation time and in effective operation time (net working time per unit) during half-hourly periods of the day, and between morning and afternoon.

3. In relation to methods of work, to determine if there is a significant change in the time required to perform any of the manual elements of the operation during half-hourly periods of the day, and between morning and afternoon.

4. In relation to delays, stoppages and other nonproductive periods, to determine if there is any significant change in the total amount, types, and percentages of delays during the operation or any of its elements during half-hourly periods and between morning and afternoon.

5. In relation to methods and organization of work, to determine what changes appeared in the operator's work methods throughout the day.

OPERATION

To carry out the study under proper conditions so as to secure valid results that may be applicable to a work situation, a factory operation was chosen

for study and observed in its normal environment for a period of six months. The operation selected was standardized, man-controlled, manual, repetitive, required a fair amount of skill for its execution and was in sufficient demand so that two or more operators always had a back-log of work before them. It was performed in a modern West Coast metal fabricating plant, employing 700 employees. Two well-experienced female operators, with occasional help, performed the operation under pleasant, clean and quiet working conditions, for a 40-hour week. During the day there were two ten-minute rest periods, one in mid-morning and the other in mid-afternoon. Both operators who had been on this particular operation for three years, performed the same task and were paid on an hourly basis.

In this semi-skilled light assembly operation, the operators prepared small motor armatures by straightening the lead wires, punching them into slots and then soldering the wires to the commutator. The operation combined many different manual motions and was flexible enough so that changes in methods of work were possible at the operator's discretion. The average time to complete a unit was approximately four minutes and the average daily production varied between 70 and 80 units. Production curves of the operation indicated the definite presence of "fatigue" effects. Figure 1,A shows the combined average productivity for each operator for the pre-test, test and post-test periods.

The observer spent considerable time with the operators in orientation and gaining acceptance (12, 210). He was present for a six-month period whether taking data or not. To determine whether any overt changes in operator behavior took place as a result of the presence of the observer, i.e., to test the representativeness of the observation period, the study was divided into three phases. Four weeks after the operators were introduced to the notion of a study, a pre-observation period began which continued for 28 working days. The object of setting aside this period was to collect production data which would be representative of non-study or average factory conditions. Hourly production records were compiled during this period by the operators, the observer being present for only one to two hours per week. Following the first phase, there began an actual observation period of 31 working days during which the investigator was continuously present recording data, although the operators could not determine when data were being collected. After this and following the removal of the recording equipment, came a post-observation period of nine days. The observer was not present during the last period, and hourly production data were again collected by the operators.

The criterion used to compare the three periods was the average daily production, recorded independently for each operator. Since there was no statistically significant difference between daily production averages for the three periods, it was inferred that the observation period was representative of average factory conditions.

During the observation period, two methods of data collection were used. All-day time studies were taken to collect information on production rates, speed of performance of the operation and its elements, and the magnitude and types of delays or stoppages. In addition, micro-motion pictures, with a clock in the film, were taken at regular intervals during the day to collect information about minute variations in work methods and changes in time required for the motion-elements of the operation. The photographic and time recording equipment were so arranged that the operators did not know when data were being recorded.

RESULTS

It may be well to reiterate that the results reported below came from observing a repetitive manual operation which was man-controlled and although standardized, permitted method flexibility and was performed under hourly pay conditions. Only the mean productivity values, in units per hour, can justifiably be used in this discussion because of the large differences in the work pattern of an individual from day to day. Individual daily observations are characterized by wider variability than observations between days.

1. *Variations in production:*

There was no statistically significant difference in production (units per day) per day of the week. This appears to be contrary to many previously reported findings which have indicated the presence of a Monday effect, i.e., lowest production on Monday. In a review of a number of these studies, however, it was found that the data were not subjected to statistical tests of significance.

2. *Diurnal variations in production:*
   a. Production was significantly greater in the morning than in the afternoon. The percentage decrease in production was 13% from the morning to the afternoon period.
   b. Greatest productivity came in the first and second hours of the morning and was lowest in the last hour of the afternoon.
   c. The work curves or productivity curves for the operators were typical of the work decrement or fatigue type, (See Fig. 1,A).

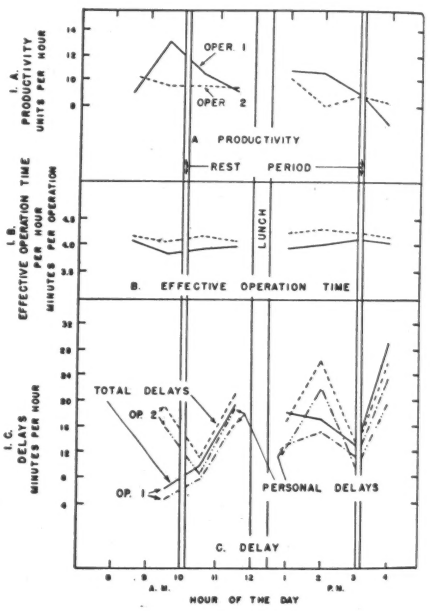

FIGURE 1—Comparison of combined average productivity, effective operation time and delays during the day for each operator.

3. *Diurnal variations in characteristics of operations:*
   a. There was no significant difference in effective operation time throughout the hours of the day or between morning and afternoon (See Fig. 1,B opposite page).
   b. The effective time for performing each element of the operation did not vary significantly between the morning and afternoon or throughout the hours

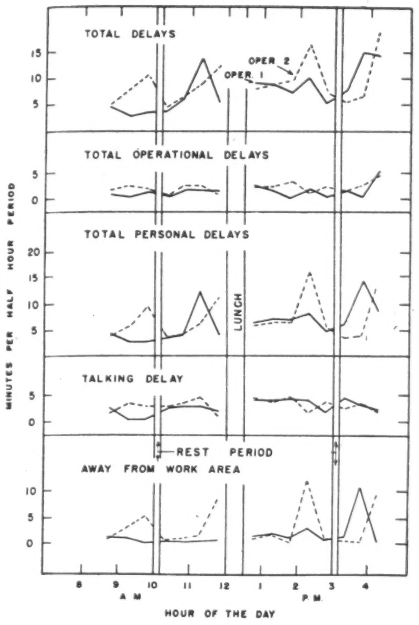

FIGURE 2—Diurnal variation of delays in minutes of delay by type per half hour during the day.

of the day. Neither was there a differential change in effective element time, i.e., no one motion-element slowed down while another speeded up to make for a small net change.

c. A micro-motion analysis of the films taken of the operation at periodic intervals throughout the day did not indicate that any changes in work methods were taking place. Neither were there any consistent changes in work methods related to the position of the repetition of the operation in the work period. Throughout all work periods an essentially standardized work method was used which contained numerous small variations since the operation was not a mere mechanical repetition. When the operators stopped to rest or talk, extraneous motions were introduced which did not follow any consistent pattern. These were nonproductive and seemed to serve merely as a mask for the delays. While the extraneous motions represented an interruption of the standardized method, they did not alter the productive motions. The percent of the effective operation time taken by each element did not change significantly during the work period or from morning to afternoon. Once again it may be inferred that there were no changes in work methods.

4. *Distribution of daily nonproductive activities:*

For the purpose of detailed examination, the nonproductive activities were listed as delays and classified by type. They occurred within the performance of an operation or between repetitions of it.

a. The total of the delays comprised a large part of the workday equal to approximately 29.7% of the available daily working time (9). Of the two major types of delays, the personal delays were a major portion of the total, being equal to 80.5% or 23.7% of the available daily working time, while the operational delays took 19.5% of the total or 6.0% of the day.

b. The personal and operational delays were classified by subtypes of nonproductive activities and their magnitudes are shown in Table I, shown below.

5. *Diurnal variations in nonproductive activities:*

a. The total of the delays was significantly larger in the afternoon having increased by 50% over the morning. Similarly the operational delays increased by 55% and the personal delays by 50%. The personal delays, talking and not working, and away from work area, increased significantly in the afternoon, accounting for 60% of the personal delay increase.

b. Delays occurred in all of the elements of the operation and were proportional to the element size except for the first, last and process elements. In the process element which was soldering of the wires to the commutators, the delays were smaller, probably because it was difficult to interrupt the sequence of movements in the element once it was started. The largest amount of delay took place in the element unravel lead wires which is of an indeterminate nature and differs in work requirements for each repetition of the operation. During the first and last elements the delays were much larger proportionate to the size of the elements. This may be attributed to the fact that they were natural stopping points in the operation. More delays occurred in the first rather than in the last element because the operator often stopped after inserting a fresh armature into the fixture.

TABLE I

Average Magnitude of Delays by Type

Types of Delay or Stoppage	Percent of Type of Delay	Percent of Available Daily Working Time
1. Operational Delays	100%	6.0%
A. Cleanup during day	39%	2.3%
B. End of day cleanup	21%	1.3%
C. Previously omitted elements	13%	0.8%
D. Inspection	10%	0.6%
E. Miscellaneous	17%	1.0%
2. Personal Delays (Excluding Official Rest Periods)	100%	23.7%
A. Talking	46%	10.9%
B. Away from Work Area	40%	9.5%
C. Rest pause (not official)	10%	2.4%
D. Early stop at end of day	3%	0.7%
E. Miscellaneous	1%	0.2%

Among the factors contributing to work decrement curves were the following:

1. The daily productivity curves were of the work decrement variety with an average of 13% less production in the afternoon than in the morning. There was no significant difference in production per day of the week. (See Fig. 1,A, on page 6).

2. There was no significant change in the effective operation time, in effective element time or in work methods in either the morning or the afternoon. (See Fig. 3, at right).

3. There was a significant increase in delays in the afternoon. Thirty percent of the daily working time was consumed by delays of which 80% or 24% of the day was for personal delays and 20% or 6% of the day was for operational delays (See Fig. 2, on page 7).

4. While there was wide variation in hourly production, it was not caused by changes in the average effective operation time either during the hours of the day or morning compared to afternoon. A very close inverse relationship existed between the amount of personal delay taken by the operator and productivity. (See Fig. 2, for diurnal variation of delays by type).

5. Much of the personal delay, about 86%, was attributed to two delays, talking and not working, and away from the work area. These were composed of many short stoppages which increased in frequency as the work period progressed.

6. Steadiness and consistency of work varied throughout the day. The operators were most diligent and consistent for the first two hours of the morning and although they stopped to talk on occasion, they returned to work immediately. After 10:30 A.M., they began to day dream and were interrupted by the slightest incident. In addition there was more talking while working which was not recorded as a delay. The same pattern was followed in the afternoon.

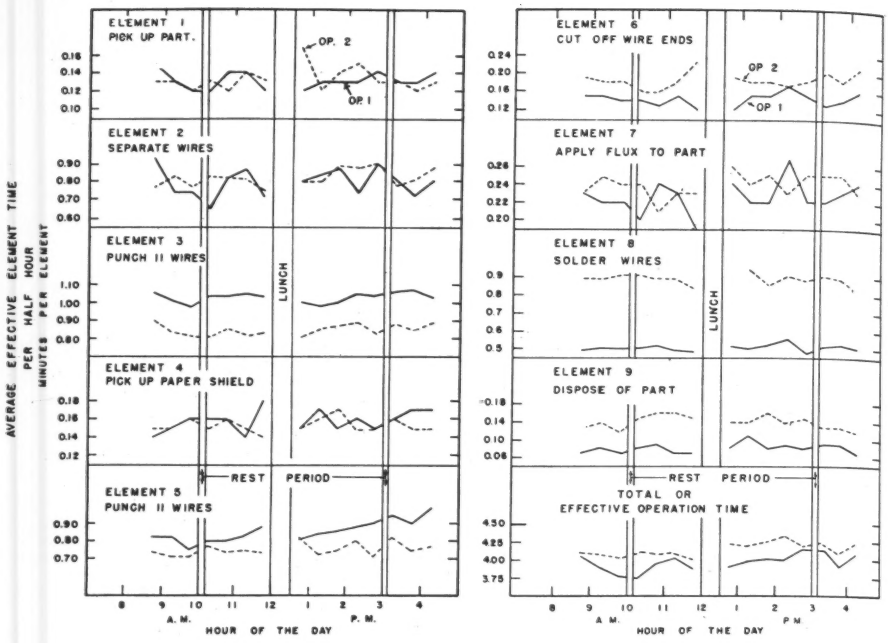
AVERAGE EFFECTIVE ELEMENT TIME PER HALF HOUR MINUTES PER ELEMENT
ELEMENT 1 PICK UP PART.
OP. 2
OP. 1
ELEMENT 2 SEPARATE WIRES
ELEMENT 3 PUNCH II WIRES
LUNCH
ELEMENT 4 PICK UP PAPER SHIELD
REST PERIOD
ELEMENT 5 PUNCH II WIRES
ELEMENT 6 CUT OFF WIRE ENDS
ELEMENT 7 APPLY FLUX TO PART
ELEMENT 8 SOLDER WIRES
ELEMENT 9 DISPOSE OF PART
TOTAL OR EFFECTIVE OPERATION TIME
A.M.
P.M.
HOUR OF THE DAY

FIGURE 3—Variation in effective element time for each operator per half hour during the day.

CONCLUSIONS

1. In a manual worker-controlled operation performed under hourly pay conditions in which productivity follows a typical work decrement pattern, the hypothesis which appears to explain the decrement phenomenon is that the operator uses the same work methods and continues to work at the same rate of speed, whenever the operation is performed, but introduces more and longer work stoppages. This is graphically illustrated in Fig. 1. Since the major part of the work stoppages are personal delays under the direct control of the operator, it may serve to explain how operators increase their productivity under conditions of high motivation. Increases in productivity may result from decreasing personal delays and not decreasing the effective operation time.

Many "fatigue" studies reported in the literature seem to indicate that there are changes in work methods through errors and fumbling and that the gross time required to perform the operation increases as the work period progresses. This would appear to be at variance with the conclusions presented here. It may be well to remember that in previous studies, which were usually performed in laboratories, the subjects were highly motivated and so took few or no stops and that the work was often paced so that the operators had to keep up. Perhaps under these conditions, where the operator cannot or does not arrange his working time so as to maintain his work methods and speed, changes in the form of fumbles, errors and increases in gross operation time do take place.

2. In the type of operation indicated, there appears to be no significant difference in production per day of the week.

3. There appears to be no significant change in effective operation time or in any of the element times during the day. Neither is there a differential change in the proportion of time taken by each element or in the work methods used by the operator. Extraneous motions are introduced which are nonproductive and serve to mask short work stoppages. These may interrupt the work pattern but do not change the work motions themselves.

4. The cumulative loss in productive working time (about 30% in this case) is considerable although each stoppage or delay is small. The magnitude of the loss is similar to the average losses determined in studies made in England in the 1920's (9). Delays and work stoppages increase significantly as the day progresses and more time is spent in personal delays and stoppages, including time away from the work area, in the afternoon than in the morning. Additionally, more time is taken in operational delays in the afternoon than in the morning. The delays and work stoppages cluster about the natural stopping points in the operation which happens to be at its beginning and end.

5. Two operational or working hypotheses and one logical hypothesis suggest themselves in regard to constant

effective operation time. They follow:

a. That in manual worker-controlled operations, the operator performs at his physiological limit and when he can do so, seeks relief by controlling the ratio of non-working to working time.

b. That in manual, worker-controlled operations, the operator performs with a firmly-established habitual pattern in carrying out the requirements of the operation. This might be related to a personal criterion of comfortableness. The pattern may be established by (1) training experience; (2) the norms set by the supervisor or the individual's perception of what is acceptable; and (3) the norms established by other workers or (4) the transfer of the individual's prior experience.

c. Based on certain psychological theories, logical hypotheses can be derived, such as, that within limits, productivity is a function of motivation and that the constant effective operation time is related to the egoistic drive of the individual in satisfying his own demands as to his performance on the job.

Under all these hypotheses, changes in productivity may result from changes in motivation and from job redesign which removes parts of the operation or reduces its work requirements. However, under the first hypothesis, with a given operation, only small changes in productivity may be expected without matching the physiological capacity of the individual to the requirements of the job. Under the second hypothesis, training or retraining to establish new work patterns may lead to changes in productivity. Changes in productivity under the third hypothesis would result from changes in motivation and in raising the individual's level of aspiration in regard to such criteria as personal satisfaction, sense of achievement, etc.

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A New Time Study Tool*

By DALE JONES

Mechanizing the time study operation to achieve better results.

MOST TIME study departments have two needs in common: (1) a need for a time study technique more precise than the conventional stop-watch time study method, and (2) a means of insuring common agreement among time study men as to what constitutes normal productive effort. This paper describes a time study machine which was recently developed to fulfill both these needs. The machine permits time study departments to "tailor-make" the synthetic times for movements peculiar to their plant activity and to test the rating ability of time study men under actual on-the-job time study conditions.

The time study machine permits precision timing of elements or movements as small as .01 min. in duration to the nearest .001 min., in sequence, and in a graphical manner which readily lends itself to statistical analysis. The machine also enables the time study man to simultaneously time and rate and to graphically post estimated elemental normal times without the necessity of taking his attention off the operator. In brief, the time study machine has three principal uses:

1. Precision timing for purposes of developing standard or synthetic data;
2. simultaneous precision timing and rating for regular time study purposes;
3. testing of rating tendencies and abilities.

MACHINE

The time study machine consists of five basic mechanisms:

1. A synchronous motor which revolves the cylinder-bearing shaft at a constant speed at 4 rpm as long as the machine is in operation;
2. six mutual, chart-bearing cylinders which revolve with the shaft when timing their respective elements;
3. the rating and recording mechanism, consisting of six vertical reciprocating knob-bearing indicators, which move horizontally when revolved and vertically to post points to their respective cylinder graphs when depressed by the operator of the machine;
4. various mechanical and electrical components which control the starting and stopping of the cylinders;
5. pilot lights and buzzers which insure against mechanical error within the machine.

FIGURE 1—The time study machine in use.

The time study machine, in use, is illustrated in Figure 1. There is a rating dial in the center of the machine. When the time study man is rating during the time study, or during rating practice, he attempts to keep the rating dial "in tune" with the operator's productive effort. A turn of any one of the knobs will cause all of the indicators within the machine to move an equal distance horizontally along the abscissas of the cylinder-borne charts of normal times. The rating mechanism and the normal time curves on the elemental cylinders are so related that one "click" of the knob will move the indicators (and the rating dial) five percentage units along the chart abscissas.

Figure 2 illustrates the time study

* The writer wishes to acknowledge the very helpful counsel and encouragement, in connection with this project, of Professor D. B. Porter, Chairman, Department of Industrial and Management Engineering, New York University and pioneer of SAM.

HIGHLIGHTS ON THE AUTHOR

Dr. Dale Jones is Associate Professor, School of Industrial Engineering, Georgia Institute of Technology. This paper is the result of research on his doctorate degree at New York University. The article on page 30 of this issue carries a reference to additional research that he has done.

machine ready for use but with the cover removed. The operation being time studied has been divided into six elements. The cylinder at the extreme right is to time Element No. 1; the cylinder next to it will time Element No. 2, etc. The time study man is ready to press the knob for Element No. 6 and will do so just as that Element ends. When Knob No. 6 is depressed, Cylinder No. 1, at the extreme right, will start revolving with its ever-revolving axis for the purpose of timing Element No. 1. Just as Element No. 1 ends, the time study man will depress Knob No. 1, for the purpose of posting a point on the graph of Cylinder No. 1 and putting Cylinder No. 2 into movement so it can time Element No. 2. The foregoing procedure is followed when the time study man is merely timing elements. The method of posting estimated *normal* elemental times will be discussed later.

OPERATION

Accurate timing with the machine requires that each elemental cylinder be idling at the zero time position at the moment the time posting of the preceding element is made (See Figure 2). This condition will be met when timing all elements in successive cycles, as long as the cycle times exceed .25 min., the time required for one revolution of any cylinder. In cases where the cycle time is less than .25 min., accurate use of the machine requires that at least alternate cycles be timed as previously described. If, for any reason, a cylinder is not idling in its zero time position at the moment the knob for the preceding element is depressed, the time study man operating the machine is warned of the pending time error by means of a buzzer signal. He can then avoid completely depressing the knob for the element being timed, thus avoiding an erroneous posting to the cylinder chart.

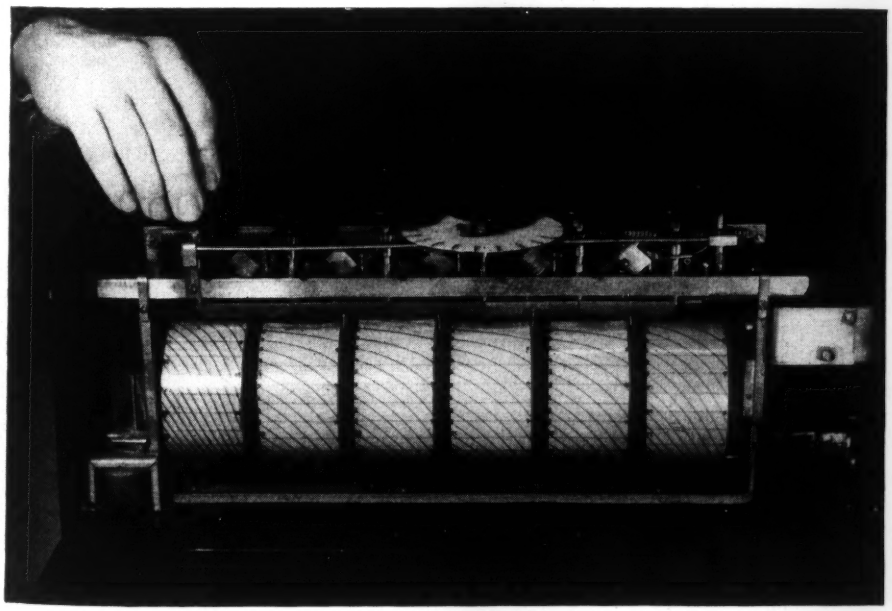

FIGURE 2—The time study machine ready for use—cover removed.

When the time study machine is used to study successive elements in successive cycles, the maximum number of elements the machine will accommodate at one time is six and the minimum number is three. If, for example, the cycle is divided into four elements, the time study man need only turn a special switch knob to the Element No. 4 position. Then, each time Knob No. 4 is depressed, denoting the ending of Element No. 4 and the beginning of Element No. 1, Cylinder No. 1 starts revolving from the zero time idling position, timing Element No. 1. Although the machine was developed principally for the purpose of time studying short elements, there is no limit to the length of an elemental time which any given cylinder can time. This is possible because any given cylinder stop, which causes its cylinder to idle in the zero time position when lowered, is automatically raised at the moment its cylinder begins revolving and remains raised, permitting uninterrupted movement of its cylinder, until the moment the posting to its cylinder graph takes place. When an element exceeds .25 min. duration, that element's cylinder will revolve more than one revolution, in which case the engineer must note the number of revolutions of the cylinder, as revealed by the cylinder's pilot light which glows at the completion of each revolution, in order to later determine from the cylinder chart, the elemental performance time.

The time study machine is operated in a somewhat different manner when it is used to post estimated normal elemental occasion times only, i.e., when the time study man desires to use only individually rated elemental performances in determining normal times for the elements, or when the machine is being used for rating practice. As previously noted, the time study machine operator can make an equal change in the horizontal (abscissa) setting of all of the elemental end-point indicators by merely revolving (clicking) any one of the indicator knobs. Therefore, since the rating dial on the top of the machine reveals the position of all of the indicators in relationship to their respective normal time curve abscissas, and since the normal time curve ordinates are automatically accommodated by the revolving of the cylinders, the engineer can post estimated elemental normal times to the cylinders by:

1. Keeping the rating, shown in the rating dial window, set at his estimate of the operator's productive effort, and

2. depressing the proper knobs completely when it is desired to make a posting and only partially when it is desired to avoid posting due to inability to rate certain elemental performances.

Figure 3 illustrates a back view of the time study machine upon completion of a time study involving the posting of estimated normal elemental times.

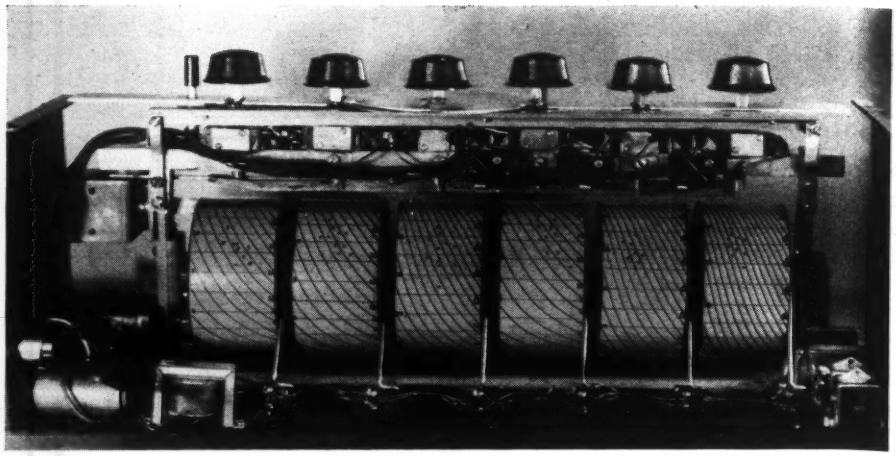

FIGURE 3—The machine-made time study results (postings enlarged for illustrative purposes).

USE

By inspecting the dispersion of the estimated normal time postings among the normal time curves on any given cylinder, the engineer can judge whether the consistency of the estimates warrants their use for purposes of setting the normal time for the element under consideration. Of course, the unavoidable random methods variations inherent in the element itself must be taken into consideration when making this analysis. When the engineer finds abnormal dispersion among the postings for a given element in the light of observed random methods variation, he should re-study the element for the purpose of improving on his consistency of rating judgment, and consequently probably improving on his average rating accuracy. The values of the postings are determined by interpolating between the two normal time curves abounding each posting. When the postings show little dispersion they may be visually averaged with close accuracy. Even when the dispersion is great, the averaging process can be substantially simplified by selecting, as a base line, the normal curve which seems closest to the average and then adding the net deviation of the postings from this line to the value of the line. Before the paper graphs are filed away, standard data information such as the beginning and, end pont and content of the element and details pertaining to the relevant variables of the element are written on same. Then new graphs are assembled to the cylinders in preparation for the next time study.

The time study machine has been found very useful as a tool for testing the rating tendencies and abilities of time study men. The following procedure is recommended when the machine is used for this purpose:

1. Select and standardize an operation having a typical cycle length.

2. Divide the cycle into six or less elements.

3. On the basis of average opinion of two or more well trained time study men in the plant who are familiar with the operation, determine the estimated normal time for each element of the cycle.

4. With colored pencil draw the normal time curves for the various elements on their respective normal time graphs. Also with colored pencil, draw normal time curves denoting plus and minus 5% and 10% error on the normal time graphs.

5. As the standard operation is performed with planned variation of productive effort, have the time study man post individual estimated elemental normal times with the time study machine, as previously described.

6. Analyze the tested engineer's individual and average errors and make record of same on the paper graphs.

7. Have the time study man repeat the rating test, attempting to correct tendencies of error, and, on the basis of several test results, determine his rating improvement progress.

TESTS

To date, the time study machine has been tested in two ways. First, the accuracy of the machine as a timer was tested. These tests involved five practicing time study engineers who used the machine to time sound intervals played on a wire recorder. The average error in the total of 300 timings was .0011 min. The average deviation of the timings about their respective averages was .0009 min. Second, the precision of the machine as a means of establishing elemental normal times was compared with that resulting from the decimal minute continuous time study method. In these tests the above mentioned engineers time studied each of two typical industrial operations alternately with the time study machine and the stop watch. Each engineer made eight time studies with the stop watch and eight time studies with the time study machine, in the manner previously described. Typical test results are shown in Figures 4 and 5 (See opposite page). Note, in the machine made time study results illustrated in Figure 5, the following relevant things:

1. Only estimated normal elemental times are posted in the elemental performance boxes. It will be recalled from previous description of the machine made time study technique that the time study observer fully depresses the elemental indicator knob to plot a point on the cylinder chart below only when he feels that he has accurately set the machine's rating dial to correspond to the operator's productive effort. This explains why the number of posted estimated elemental performance times varies among elements and among studies.

2. The average of the recorded estimated normal elemental times for any given element is the over-all estimated normal time for that element. None of the estimated normal elemental times is discarded in establishing the over-all estimated normal elemental times.

ELEM.	ELEMENT DESCRIPTION	END POINT	CYCLE 1	2	3	4	5	6	7	8	9	10	TOT.	AVE.	RTG.	N.T.
1	Assem. (4) Grills to Frame	Hands start reach for inserts	10	8	8	9	9	7	9	8	8	9				
			10	87	1.68	2.35	3.11	3.84	4.56	5.27	5.96	6.64	.85	.085	1.10	.094
2	Assem. (4) Inserts to Grills	Hands start reach for knob & glue	15	16	12	16	15	14	18	14	13	13				
			25	1.03	1.80	2.51	3.26	3.98	4.74	5.41	6.09	6.77	1.46	.146	1.05	.153
3	Glue & Assem. (4) Knobs to Grills	Hands start reach for paper	19	19	15	17	19	16	16	14	16	15				
			44	1.22	1.95	2.68	3.45	4.14	4.90	5.55	6.25	6.92	1.66	.166	1.10	.183
4	Wrap Assembly	Hand starts reach for tape	16	17	13	16	13	17	13	13	13	12				
			60	1.39	2.08	2.84	3.58	4.31	5.03	5.68	6.38	7.04	1.43	.143	1.05	.150
5	Tape Package	Hand completes smoothing 2nd pc. tape	10	12	10	9	12	9	9	12	8	10				
			70	1.51	2.18	2.93	3.70	4.40	5.12	5.80	6.46	7.14	1.01	.101	1.10	.111
6	Aside package. Get frame.	Hand starts reach for grills	9	9	8	9	7	7	7	8	9	7				
			79	1.60	2.26	3.02	3.77	4.47	5.19	5.88	6.55	7.21	.80	.080	1.05	.084

FIGURE 4—Typical Results of Stop Watch Study of Air Conditioning Front Assembly.

ELEM.	ELEMENT DESCRIPTION	END POINT	CYCLE 1	2	3	4	5	6	7	8	9	10	TOT.	AVE.	RTG.	N.T.
1	Assem. (4) Grills to Frame	Hands start reach for inserts	.082	.078	.081	.087	.098	.088	.083	.093	.088		.778	.086		.086
2	Assem. (4) Inserts to Grills	Hands start reach for knob & glue	.142	.149	.132	.138	.142	.151	.164				1.018	.146		.146
3	Glue & Assem. (4) Knobs to Grills	Hands start reach for paper	.159	.170	.172	.192	.182	.172	.173	.190			1.410	.176		.176
4	Wrap Assembly	Hand starts reach for tape	.138	.158	.166	.146	.168	.156					.932	.155		.155
5	Tape Package	Hand completes smoothing 2nd pc. tape	.103	.116	.103	.110	.092	.093	.096	.089	.097		.899	.100		.100
6	Aside package. Get frame.	Hand starts reach for grills	.098	.100	.081	.089	.097	.081	.091	.083	.088	.091	.899	.090		.090

FIGURE 5—Typical Results of Machine Made Study of Air Conditioning Front Assembly.

For the conditions tested, three of the five engineers were significantly more precise in making time studies of the long-element operation using the time study machine than when using the stop watch. On the other hand, as indicated in Figure 6 (on page 14), all five of the engineers showed significantly greater precision in making time studies of the short element operation using the time study machine than when using the stop watch.

ADVANTAGES

The time study machine has proved very useful as a time study tool in industry. The machine can be credited with the following advantages:

1. The graphical recording principle, yielding array postings, provides an excellent means for (a) applying Wiberg's methods of analysis[1] of cause of variation of observed times, and (b) statistically analyzing the dispersion of estimates of elemental normal times.

2. The graphical recording principle makes it possible to quickly and accurately establish performance and normalized performance times visually.

3. Several operators and/or machines may be conveniently timed with the machine because it contains six timing cylinders and the indicators can be indexed to fifteen positions.

4. The time study observer can devote approximately 95% of his attention to observance of the operator when making time studies with the time study machine and still work in divisions of less than .05 min.

5. Sequences of up to six movement combinations as small as .01 min. each can be timed with precision, permitting the acquisition of refined standard data.

CONCLUSION

The time study machine has two distinct shortcomings. First, because of the weight of the machine, and the necessity of plugging it into an electrical outlet, the user of the machine is not able to move about to the extent necessary in some time studies. Second, because of the machine's many moving parts, switches and circuits, its proper adjustment is difficult to maintain.

The development of a time study machine entailing the basic principles described above, with considerably fewer moving parts and electrical controls is under way. This new model, much lighter in weight and portable, is intended for general use in industry. ★

1 Wiberg, Martin, "Work Time Analysis," Personnel Journal, Volume 19, 1940.

DETERMINATION OF SIGNIFICANCE OF DIFFERENCE BETWEEN TIME STUDY PRECISIONS OF TIME STUDY MACHINE AND DECIMAL MINUTE STOP WATCH

Air Conditioning Front Assembly

(Consisting of six elements with normal times ranging from .08 to .20 min.)

	Standard Deviation*		Degree of Freedom				
Engr.	Mach.	Watch	Mach.	Watch	F	F Necessary for Significant Difference**	Is Difference Significant?
1	.0071	.0075	23	23	1.1	2.73	No
2	.0050	.0099	23	23	3.5	2.73	Yes
3	.0023	.0047	23	23	4.2	2.73	Yes
4	.0039	.0095	23	23	5.9	2.73	Yes
5	.0058	.0065	23	23	1.3	2.73	No

Grill Replacement Assembly

(Consisting of five elements with normal times ranging from .05 to .09 min.)

	Standard Deviation*		Degree of Freedom				
Engr.	Mach.	Watch	Mach.	Watch	F	F Necessary for Significant Difference**	Is Difference Significant?
1	.0016	.0033	19	19	4.3	3.03	Yes
2	.0024	.0062	19	19	6.7	3.03	Yes
3	.0021	.0063	19	19	9.0	3.03	Yes
4	.0016	.0047	19	19	8.6	3.03	Yes
5	.0026	.0050	19	19	3.7	3.03	Yes

*These values reflect the deviations of all normal times from their respective $\bar{X}$ values. Each $\bar{X}$ value represents an average of four estimated normal times for a given element, resulting from four ten-cycle studies.

**For a concise description of the application of the F test for significance of difference, see "Are Your Findings Trustworthy?," by Prof. John Enell, New York University, Department of Industrial and Management Engineering.

FIGURE 6

The Dynamics Of The Manufacturing Interval

By W. VAN ALAN CLARK, JR. and WILLIAM E. RITCHIE

The authors stress study of the over-all system as a technique of analysis.

TODAY, IN many firms, management finds it increasingly difficult to gain an over-all appraisal of the company's manufacturing system. Specialization of personnel along functional lines is now a pervasive part of most manufacturing organizations and is common within many industrial consulting firms. One group may study production control problems, another specializes in layout and materials handling; the controller requests a study of inventory levels to determine whether they can be reduced while the inventory control group experiments with improved methods of forecasting inventory requirements. Although each problem area is well covered, no one group is apt to study the firm's production system as a whole to discover how well it meets the company's over-all manufacturing and sales objectives.

It is generally accepted that there is no "one best system" for production planning, shop organization, inventory control and the like, although there is usually one most acceptable for a given set of circumstances. This thesis however, is apt to leave a plant's management wondering if it has not become the victim of circular reasoning. The production control system used is the best for the current plant layout. The layout is best for the existing shop organization. The shop organization is purported to fit in well with the production control system. Again, this situation reflects the difficulty of grasping the production system as a whole.

An approach to this problem, which has worked well in a number of companies, is a study of the firm's manufacturing interval. The manufacturing interval is simply the actual time required to manufacture a product. It includes the span of time between the appearance of materials ahead of the first operation and the arrival of the finished product in the shipping room or in stock. This interval is usually much longer than the sum of the operating times involved in processing the product; it is generally much shorter than the total time required to process an order when the product is not immediately available in stock.

Ideally, a customer's order would at once trigger production of a product. The product would move through the various operations required to form it without any interruptions. Shipment would follow on the heels of the final operation. In any plant manufacturing by lots, this is indeed an idealized picture. Typically, the paperwork and preliminaries required to get an order into production will consume days, weeks or even months. Production will proceed intermittently, with varying amounts of delay time during and between operations. Shipment may or may not take place immediately. According to our definition of manufacturing interval, we are not concerned here with the first possible source of delay, the time required to prepare to manufacture the order. This is a somewhat separate and narrower problem. We are mainly interested in the delays which arise once everything required to process the order is available, and which stretch the actual manufacturing time beyond that theoretically possible.

The study of a plant's manufacturing interval directs attention toward the whole complex of production and avoids the more normal functionalized forms of analysis. It is aimed at discovering why a certain number of days or weeks is required to produce a product; it includes in-process inventories, sources of delay, shortages and machine utilization. Throughout such a study, the questions of "Why this delay?", "Why this accumulation?" inevitably lead to more detailed studies of how they can be eliminated, at what cost and to what advantage.

Beyond its usefulness as a convenient vehicle for an over-all production study, the manufacturing interval is an extremely important thing in itself for any firm. In the first place, this interval is usually a major portion of the lead time which exists between demand for an article and its shipment from the firm. The length of the lead time is an important factor in the cost and complexity of a company's planning and control systems. The longer the lead time, the more erratic the "hunting" oscillations of the firm's production are likely to be as they exceed and come under required levels of output. Long lead times complicate the problems of forecasting and inventory control.

The amount of material tied up in work-in-process inventories varies directly with the length of the manufacturing interval. These inventories may account for a sizable portion of the company's total working capital and, in manufacturing operations which have considerable process depth, may represent more value than all the other inventories and uses of working capital put together.

The length of the manufacturing interval, through its effect on manufacturing inventories, has a marked effect on the production floor space required. Industrial floor space is growing to be a large element in cost. This is due, of

HIGHLIGHTS ON THE AUTHORS

W. Van Allan Clark, Jr. and William E. Ritchie are both Assistant Professors of Industrial Management at Massachusetts Institute of Technology. Professor Clark is a member of the Boston SAM Chapter and of the American Materials Handling Society.

course, to the rising standards of industrial working conditions in terms of heat, ventilation, noise level, lighting and general elbow room. It is not uncommon these days to find between $15 and $20 invested per square foot of floor space; this means that the firm's self-rental cost must be in the order of a dollar and a half to two dollars per year. It is also not uncommon to find that two-thirds of a company's manufacturing space is devoted to manufacturing inventories. A reduction in the firm's manufacturing interval is, therefore, likely to play an important role in making better buildings and working conditions possible at lower cost.

While studies of the manufacturing interval often turn up unexpected factors, they usually lead to the discovery of problems and opportunities for improvement in two main areas, production management and production engineering. Some of the issues involved in reducing the manufacturing interval through improvements in these areas may be illustrated, in a general way, through a few examples.

PRODUCTION MANAGEMENT

Investigation of the manufacturing interval may uncover problems in any area of production management. Those most frequently encountered, however, center in planning and forecasting, inventory control, production control or quality control. Many specific examples can be cited to show how each of these areas can cause delays in manufacturing. These examples merely illustrate the kind of situations which may exist. The important point is not the particular illustration chosen but the fact that several of these problems may exist in different areas at the same time; the most fundamental may be the least obvious. The breadth of a manufacturing interval study reduces the chance of not recognizing the most critical area. It is an effective tool to establish priorities for improvement studies and to coordinate improvement efforts in different areas.

Although much of the work of production management may be done in offices, its effects on the manufacturing interval are best noted out in the shop itself. This pile of material, that idle machine, those confused lots, all raise the question, "Why?" or "What has caused this?" The assembly floor of one company showed much evidence of confusion. Despite what appeared to be proper layout, the space was cluttered with half-assembled equipment and quantities of parts. Orders were a long time in process. Study of the delays uncovered a lack of planning and improper coordination of the parts for each job as they followed a wide variety of routes through the fabricating departments. Procedures for releasing parts from finished stock also needed overhauling. A situation in another plant, which appeared much the same on the surface, stemmed from improper control of inventories of purchased parts. In still another case, the disruption of assembly operations was caused primarily by parts inspection procedures and a high rejection rate. A centralized inspection department acted as a bottleneck in the flow of finished parts to assembly; parts piled up here because of poor scheduling and organization of inspection operations. Many lots of critically needed parts were held up unnecessarily before inspection took place, and were then often decimated when defectives, far in excess of the normal allowances, were found. All these cases illustrate one problem; yet, in each, the solution to the problem lies in a different area.

Large in-process inventories, cluttering the shop and hampering operations, can stem from many different causes. This problem, in one firm, was the result of releasing to production, lots which were much too large. Boxes of parts sat ahead of and behind one operation after another, while the whole lot moved slowly through the plant. The quantities involved were well above the minimum for economic runs. Reduction in lot sizes reduced the amount of material on the floor and left sub-lots in raw stores until capacity was available to move them quickly through the process centers involved. In another plant, the same situation resulted from ineffective dispatching and follow-up. Orders frequently remained for some time in a department after work on them was completed, and the control system did not readily bring this fact to light. In a third company, rejected items awaiting rework accounted for a great deal of the in-process inventory. Further study showed that the gauges used by the operators were often inaccurate. An improved gauge control program helped remedy the condition.

A long manufacturing interval is sometimes the result of excessive downtime and poor utilization of equipment. In addition to the obvious technical problems of improper maintenance or faulty tooling, many functions of production management can contribute to this condition. A control system which does not insure timely deliveries of materials, tools and instructions to the machine can cause idleness. A system in which machine loading is performed haphazardly will do the same; this is particularly true where sequences of colors, similar set-ups and alternative processes must be considered. Improper control of rush orders may keep machines idle with frequent broken set-ups. In one case, a system of order priorities worked to put 30% of all manufacturing orders as written and 75% to 80% of all orders actually in the shop, in a "rush" category. The resulting confusion lost hundreds of hours of production at a time when maximum production was sorely needed to clean out a backlog. An area as far removed from the production floor as that of forecasting sales, inventories and production requirements can be an important contributing factor to machine idleness. Idleness caused by lack of work, by confusion of orders and by frequent changes of requirements, in one company, pointed directly back to neglect of the planning and forecasting function. While a study of the situation did not result in the discovery of a "crystal ball," more effective correlation and use of information that was available made distinct improvement possible.

Although most of the preceding examples have been drawn from different companies, it is important to realize that a number of these can exist in one company at the same time. Because of this, the obvious course may involve a concentration of effort in the area first recognized as a problem source. Where this occurs, results may be disappointingly limited. One of the prime advantages of a manufacturing interval study is the breadth of vision it demands. This minimizes the chance of overlooking the contribution of several areas of production management to a production problem. Even after several routes to improvement become evident, it is very likely that only one can be pursued at a time. In this case, however, management has made a choice among several well-defined alternatives; blind chance, or a strictly functional view, have not

channelled improvement funds and effort toward only one side of some many-sided problem.

PRODUCTION ENGINEERING

Our discussion of the production management aspects of the manufacturing interval should have served to indicate that a major source of delay and a major source of control expense is due to interdepartmental movement of materials. The first step toward reduction of the manufacturing interval through production engineering is usually a study of shop organization in an effort to find ways to develop some departments which have product as well as process depth. A traditional shop organization in a firm, with varying production rates and any substantial investment in equipment, is a departmental or "job-shop" layout. This type of layout, with departmental groupings arranged by process, has many advantages. It keeps certain types of skills conglomerating within one supervisory area. It permits the development of supervision which is highly proficient within a given technical processing field. It is possible, through extensive use of centralized planning, to obtain very high machine utilization in process centers even though many different products and job orders are being worked on at the same time.

A study of shop organization from the standpoint of the manufacturing interval is likely to reveal that some changes may be made to develop departments which, while still primarily process oriented, have some product depth. This will reduce the number of interdepartmental moves and substitute intradepartment moves which may be made on a rather informal basis without centralized planning. In one firm, it was found that a major source of delay in manufacturing the product was the pile-up of material entering and leaving a burring and filing department. By eliminating this department and spreading the personnel through the various process departments which had need for burring service, a whole series of interdepartmental moves were eliminated. Although several more persons were needed to carry out the burring and filing operations under this new system, savings in floor space and materials handling expense more than balanced the added cost. The development of inexpensive, portable machinery to replace heavy fixed installations sometimes makes possible drastic revisions in shop organization. In one firm, the use of portable degreasers made possible cleaning and degreasing operations in the departments where the material was being machined, and eliminated an interdepartmental move to a separate degreasing area.

Manufacturing interval studies can also direct attention to the layout of men and equipment within departments. In one firm it was found that a major portion of the floor space was occupied by tote boxes full of material ahead of and after completion of operations by individual machines. Since the department possessed considerable process depth, it performed four or five operations on a given lot. Study of the processing sequences revealed that it was possible to develop "product villages," or groups of machines, each working in sequence on a product. Materials were moved from one machine to the next in small trays, or even individually, so that the elapsed time of products going through the department was greatly reduced. In this instance, the machines were still scheduled as units, and production planning still operated on the assumption that the department was entirely process-centered. Nevertheless, the change in layout permitted real economies in the manufacturing interval.

In another factory, the production volume of one product was almost twenty times that of any other. In this instance, product villages were arranged which gave real line production for portions of the operations sequence on some of the pieces involved. Not only were materials handling and floor space savings realized as a result of piece by piece rather than lot by lot handling, but the six to a dozen machines in each village were scheduled for the high volume product as units. This resulted in major savings in planning, dispatching and follow-up expense. During the portions of schedule periods when the individual machines were working on other products, they were of course scheduled individually.

Line production is a desideratum in manufacturing interval reduction. Some of the aspects of this straight line or "product controlled layout" production are much misunderstood, however, especially when manufacturing operations involving machinery are considered. Line production fabrication does not, as a rule, decrease direct manufacturing cost. It tends instead to increase direct costs, since it usually results in poor use of skilled personnel and poorer machine utilization than would be the case in a process-centered layout. Machines themselves do not perform their operations any faster merely because they are placed in a line. Rather, the line must proceed at the rate of the slowest machine. There may be considerable downtime as a result of the dependence of one machine upon another. It is difficult to balance production lines which involve machines because the operations are not divisible. Machine tools sometimes show amazing differences in rates of output; even when volume is high enough to permit balancing through having groups of machines feeding sin-

CHAPTER STANDINGS
As of March 1, 1953

MEMBERSHIP		CHAPTER PERFORMANCE AWARD	
New York	420	N. New Jersey	4507
New Jersey	349	Asheville	3040
Philadelphia	324	Philadelphia	2914
Chicago	317	Boston	2732
Cincinnati	309	Lancaster	2440
Cleveland	296	Greensboro	2065
Washington	246	Allentown	2030
Boston	231	Milwaukee	1915
Pittsburgh	209	Hudson Valley	1895
Detroit	185	Pittsburgh	1741
Los Angeles	150	Trenton	1465
Lancaster	148	Charlotte	1065
Milwaukee	144	Baltimore	1055
San Francisco	118	Wilmington	996
Dallas	105	Chicago	907
New Brunswick	105	New York	903
Indianapolis	99	Washington	876
Dayton	96	Detroit	825
Greensboro	94	Birmingham	805
Hudson Valley	93	Montreal	795
Asheville	90	Bridgeport	787
Baltimore	86	Indianapolis	771
New Haven	86	San Francisco	740
Charlotte	72	Los Angeles	727
Hartford	67	Richmond	707
Bridgeport	63	New Brunswick	681
Montreal	62	Atlanta	651
Worcester	61	Central Pa.	605
Atlanta	60	New Haven	563
Wilmington	60	Cincinnati	505
Allentown	59	Columbus	500
Columbus	56	Greenville	490
Providence	56	Hartford	481
St. Louis	56	Portland	481
Trenton	56	Nashville	400
Reading	50	Providence	376
Central Pa.	49	Worcester	375
Greenville	49	Manchester	370
Louisville	48	Knoxville	345
Birmingham	48	Binghamton	260
Knoxville	46	Dayton	241
Binghamton	46	Wilkes-Barre	240
Richmond	45	Central N. Y.	140
New Orleans	44	Cleveland	106
Manchester	44	Kansas City	80
Western Mass.	42	Dallas	70
Wilkes-Barre	41	Western Mass.	60
Portland	38	New Orleans	55
Twin City	36	Louisville	40
Central N. Y.	33	Reading	20
Sacramento	32	Appleton	—
Appleton	29	Baton Rouge	—
Baton Rouge	28	Clearing	—
Clearing	27	Madison	—
Madison	25	Sacramento	—
Nashville	25	Stamford	—
Kansas City	24	St. Louis	—
Stamford	8	Twin City	—

gle machines or larger groups, the per cent utilization may be very poor. It is not uncommon to find average machine utilization as low as 60% in lines, while 80% to 90% is a realizable goal in many process-centered operations.

Savings from the use of production lines for fabrication come largely from reduced indirect costs through easier production control, lower manufacturing inventories, less floor space and simpler dispatching and materials handling. However, these savings are likely to be hard to prove; the costs of lower output per machine and per worker are easily calculable whereas savings in floor space, savings in materials handling expenses and savings in control expenses are harder to forecast accurately.

In assembly work or work in which the human being is the controlling factor, line production is much more easily understood and usually involves larger savings. In this case, the line production device promotes the use of job specialization and the breakdown of one job into several smaller jobs. Large direct labor savings may result. This is the reason that the line production device is more common in assembly work than in fabricating operations.

The problem of machine utilization is generally the key to manufacturing interval reduction, through the use of line production. In one firm the production volume of some of the firm's smaller products was so great, compared to the rest of the firm's production, that the burden of proof definitely rested upon doing other than separating this manufacture from the rest of the plant and establishing a production line to make these products. Study of the separation proposal showed that, while line production was feasible for much of the process, several of the critical operations would have to be performed on very expensive machinery which would be able to get out one month's production in something like 35 to 45 hours running time. A production line for these products, with heavy machinery committed to less than 25% utilization, was of course not possible. The firm was forced to continue its departmentalized layouts, although some product villages were employed to reduce the number of intradepartment moves. In another company, on the other hand, the production volume of just one item was sufficiently great to justify the complete separation of this product from the rest of the plant. Although some inexpensive types of machinery, such as drill presses, were not used continuously, a balance was obtained which produced excellent operator utilization and reduced the manufacturing interval sharply. A product passed through this small production line in two days while it took up to two months to get a similar article through the jobbing part of the plant. Major production control savings were also realized. The line production unit eventually produced about 25% of the firm's products with little control beyond a weekly schedule of output.

Changes in processing sequence and changes in actual processing techniques are a final avenue toward reducing the manufacturing interval through production engineering. In one case it was found possible to substitute a slow speed machine for a high speed semi-automatic one, in a planned production line. Tooling was simpler and operating costs were no higher because the line was forced, in any event, to operate at the speed of other, slower machines. The development of portable, compact heat and surface-treating devices, such as induction heaters and flame hardeners, has made it possible to install processes of this nature in machining departments to eliminate interdepartmental moves. In one firm a major source of delay and pile-ups of material was found to be the return of articles, after three stages of machining, to the foundry for tumblasting. This treatment was supposedly necessary to improve the appearance of the product. Once the importance of eliminating these interdepartmental moves was realized, a study was made to find alternative methods of surface treatment of the products to improve their appearance. This eventually resulted in a better looking product at even less cost.

CONCLUSIONS

Our discussion has stressed the importance of the manufacturing interval as an indicator of the effectiveness of a firm's production system and as a technique of analysis. Reduction of the manufacturing interval may lead to improvements in required lead times, in-process inventories, machine utilization and requirements for production floor space. As it directs attention toward the whole complex of production management and production engineering functions, a manufacturing interval study avoids many of the pitfalls inherent in more functionalized investigations.

Concern for the over-all systems, rather than strict attention to its parts, has grown steadily in many fields besides production. In laying out military aircraft, for example, it is no longer possible to design airframes, engines and control mechanisms, more or less, independent of one another. Instead, it has become increasingly clear that the total dynamics of the plane and its mission must be the basis for all designs.

Modern manufacturing, too, has developed into a closely interrelated complex of functions. No one functional approach can even describe its workings. While the results of a manufacturing interval study cannot be predicted, a better understanding of the dynamics of the plant as a whole is assured. ★

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NMC INTERNATIONAL NEWS

EDITOR'S NOTE: Copy for this page, since its inception, has been provided by the National Management Council. Early in February we learned that one of the European Productivity Teams was to visit our Greensboro Chapter as part of their program in the United States.

SAM has played a major part in cooperating with the Economic Cooperation Administration and its successor organization, the Mutual Security Agency. We wrote the Greensboro Chapter asking for a story on this visit with the thought that readers of ADVANCED MANAGEMENT would be interested in knowing how the international management movement draws on SAM. The letter we received from E. G. Michaels, II, of the Greensboro Chapter, is reproduced below, in part.

A REPRESENTATIVE of the Mutual Security Agency in Washington contacted me with a request that, as a member of SAM and a member of the consulting firm of Henderson, Lindsay and Michaels, my name had been suggested as the person to contact in Greensboro, N. C., to act as the host to the German Productivity Team on February 17th and 18th for a one and a half day visit to our city.

The German Productivity Team is composed of 16 men of West German management, technical and labor representatives. They are making a six-week study of American techniques of work preparation and planning. The tour was arranged through the Mutual Security Agency in order to aid the Federal Republic of Germany to achieve a higher industrial productivity.

This contact was orginated by Mr. F. M. Holmes, Jr., a charter member and principal moving spirit in the formation of the Greensboro Chapter of SAM. Mr. Holmes, who has been in Germany for the last three years, suggested to MSA that they include a visit to the Greensboro area and the SAM Chapter of Greensboro.

The German industrial envoys attended the dinner meeting of the SAM Chapter, on Tuesday night, February 17th at the Starmount Forest Country Club. Mr. Alvin Wingfield, Jr., manager of the Royal Typewriter Co., who was the principal speaker, gave an address entitled, "The New Look in Economics."

The German members of the team, about half of whom spoke English adequately, mingled with the SAM members during the social hour before the dinner. I heard a number of voluntary remarks from both Americans and Germans about the good fellowship when the German team dispersed themselves among the regular SAM members for the dinner. The delegation listened to the speech through the use of headphone instantaneous translation equipment such as those in operation in the United Nations General Assembly for rapid translation. Traveling with the group were two interpreters who were used to translate speeches and discussions and two Mutual Security agents from Washington. The group stayed for the question and answer period which lasted an hour after the regular meeting.

The following day the group had an all day conference set up by SAM and a consulting firm of Greensboro. Following an official welcome to the City of Greensboro by the Mayor Pro Tem and a talk by Dr. Lee Ubbelohde, a scientist from Germany who is working on a special research project for Burlington Mills, the business session convened, covering the principal areas of: (1) the human problems encountered in industrial engineering work; (2) the latest of the predetermined time systems; and (3) statistical quality control.

SCHOOL ESTABLISHED

Under the auspices principally of the Industrial Union of Turin, but with important assistance from the University of Turin and the Polytechnical Institute, the Institute of Advanced Studies in Organization and Management was inaugurated on January 16, 1953, at Turin, Italy.

Impetus was given to its founding by discussions within the National Management Council in 1951 and more particularly, at a meeting in New York in June, 1952, conducted by the council where representatives of the European countries met with the heads of a large number of American Schools of Business. Professor Valetta and Engineer Olivetti, representing the Industrial Union, sent two representatives to America to secure the services of six American professors to become the first teachers in the Institute.

The group was comprised of the following professors: C. A. Anderson, Pennsylvania State College; N. G. Burleigh, Amos Tuck School, Dartmouth College; T. P. Hubin, Fordham University; M. J. Jucius, Ohio State University; A. L. Seelye, University of Texas; and C. M. Williams, Harvard Graduate School of Business. Working with them was N. R. Miller who had participated in the Stanford Research Project.

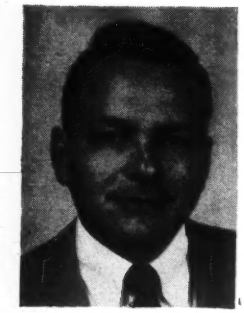
The entering class contained 85 students chosen from over 450 applicants. Of these about 60 were employed in industry and the rest were recent graduates or are now attending the University or Polytechnical Institute.

Each professor has had two or three Italian assistants who can read and write English but whose proficiency in conversation varies somewhat. These assistants have translated the American text material into Italian which has been furnished the students in mimeographed form. They also interpret the discussion that takes place between the instructor and students. This takes time and destroys the spontaneity that might otherwise exist. The language barrier is a difficulty that could be helped somewhat, if interpreters could be secured to make possible simultaneous translation, but this situation will not be overcome until the Italians themselves are equipped to take over the instruction.

The American instructors have found the work challenging, and sense a desire on the part of the Italian industrialists to have young men entering their businesses trained in American management, philosophy and methods. They themselves are anxious to acquire this same knowledge. A series of seminars conducted weekly by the Americans, from January to June, under the auspices of the Industrial Union, still continue to draw capacity audiences. ★

Thursday Morning and Luncheon Speakers

H. G. Fromm


Robert Levin

Charles G. Herbruck

M. W. Mackenzie

Preview Of The National Conference On

A CONFERENCE program is ideally structured when its subject matter treats of great needs and its speakers are tried-and-true specialists. Such a program presents new solutions for all to take home and apply immediately to pressing problems. It provides, both during and between sessions, a university environment of specialization which, nevertheless, is forced to prove itself on a practical basis through the free interchange and cold evaluation of ideas, viewpoints and varied experiences among those in attendence. The knowledge and stimulation emanating from a well-programmed conference are an intensive education and a sparkplugging of motivation and drive that are good for the soul and excellent for the job back home.

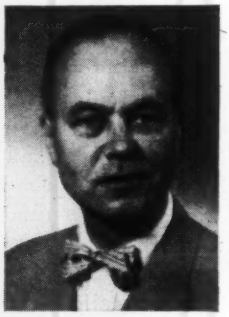
The Eighth Annual Time Study and Methods Conference, to be held at the Hotel Statler, New York City, on April 16th and 17th, is constructed for the utmost in knowledge and stimulation. The program is a tribute to the members of the Conference Committees of SAM and ASME who worked arduously in selecting topics and securing specialists to discuss those topics. The philosophy and techniques pertaining to methods, time study and costs will have an airing and analysis representative of "years ahead" thinking and application. There will be material for all to assimilate and use profitably: little as well as big business; the executive; the manager; the supervisor; the engineer; and the college senior about to make his mark in the competitive economy of our day.

In arranging the content matter of the conference, the Committees proceeded from four broad orientations: *Modern Plant Technology, Sound Solutions To Practical Problems, Recent Research* and *Progress In Work Measurement.* Each area is subdivided into its most dynamic application for authoritative discussion and analysis.

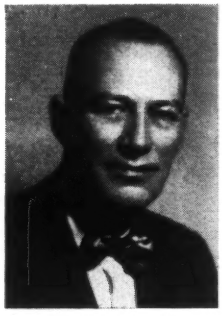
The subject, *Modern Plant Technology,* will cover "Production Planning and Layout," "Methods and Measurement," and "Incentive Management." The most successful techniques of tie-in between physical workplace and optimum performance will be detailed and illustrated. Covering these topics will be H. G. Fromm, Johnson & Johnson; Robert Levin, United Mills Corp.; and Charles G. Herbruck, The Lincoln Electric Company. Chairman of the Session will be Elles M. Derby, Manager, Management Education, Metropolitan Life Insurance Company, New York.

Included under *Sound Solutions To Practical Problems* will be, "How Far Should Incentives Be Applied?", "How to Reduce Time Study Grievances," and "How to Control Production Costs." The eternal triangle—productivity, employee willingness and cost control—will be discussed by W. W. Taylor of the Cincinnati Milling Machine Company; J. G. Gilland of the Packard Motor Car Company; and Phil Carroll, Professional Engineer, Maplewood, N. J. Chairman will be Lawrence L. Parrish, Head of the Department of Industrial Administration, University of Connecticut, Storrs, Conn.

Thursday Afternoon and Dinner Speakers


W. W. Taylor

Joseph G. Gilland


Phil Carroll

Lawrence A. Appley

Friday Morning and Luncheon Speakers

William Langenberg

L. A. Brouha, M.D.

Dr. A. Chapanis

Harold F. Smiddy

On Time Study And Methods

The area of *Recent Research* will offer discussions on the following topics: "New Techniques In Productivity Measurement," by William Langenberg of Johnson & Johnson; "Fatigue—Measuring and Reducing It," by L. A. Brouha, M.D., of E. I. du Pont de Nemours & Company; and "Contributions of Experimental Psychology to Machine Design," by Dr. Alphonse Chapanis of The Johns Hopkins University. Chairing this group will be Hugh Bogle, Supervisor, Management Engineering Consulting Section, E. I. du Pont de Nemours & Company, Wilmington, Del.

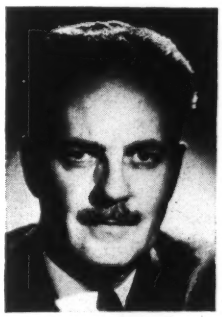
Dr. Lillian M. Gilbreth, world-famous industrial engineer and psychologist, will preside over the *Progress in Work Measurement* Session on Friday afternoon. The three best known systems—"Basic Motion Time Study," "Methods-Time Measurement," and "Work-Factor," will be explained and discussed by Gerald B. Bailey, J. D. Woods & Gordon, Inc.; Andrews M. Lang, MTM Association for Standards and Research; and Dickey Dyer, The Work-Factor Company. For the first time since their inception, these three most recent developments in time study practice will meet on common ground for analysis.

At the Thursday Luncheon, Ralph Presgrave, Vice-President, J. D. Woods & Gordon, Ltd., Toronto, Canada will introduce M. W. Mackenzie who will discuss "Canada's Prosperity and The United States." Mr. Mackenzie is Executive Vice-President, Canadian Chemical & Cellulose Company, Ltd., Montreal, Quebec. The Thursday Dinner Session will be graced by Lawrence A. Appley, President, American Management Association, New York, who will talk on the topic, "Managing for More." Mr. Appley will be introduced by Edward W. Jochim, National President of SAM, and General Manager, Personal Products Corp., Chicago, Ill. At the Friday Luncheon, a treat is in store for industrial engineers who are interested in learning practical ways to swiftly advance themselves in responsibility, leadership and financial income. Harold F. Smiddy, Vice-President of General Electric Company, New York, will discuss the subject, "Horizons for Industrial Engineers." He will be introduced by Paul J. MacClutcheon, Chief Industrial Engineer, The Nestle Company, Inc., Fulton, N. Y.

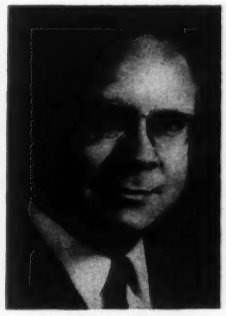
The Conference Keynote Address will be delivered by the Conference Chairman, Frederick W. Hornbruch, Jr., Chief Engineer, Rath & Strong, Inc., Boston, Mass. The Summation and Conference Closing Speech will be made by Edward W. Jochim, SAM National President.

SAM and the Management Division of ASME feel fortunate in having been able to bring together such an illustrious group of authorities in the vital subject matter presented for analyses and discussion. There is every reason to trust that the cause of greater standards of living through greater productivity will be well served by this Conference.

Friday Afternoon Speakers


Gerald B. Bailey

Andrews M. Lang


Dickey Dyer

Edward W. Jochim

Standard Data*

By PHIL CARROLL

Six advantages of the standard data method.

ALL OUR efforts in the field of industrial engineering are directed toward improving productivity. We urge the standardization of products and methods. We work toward the simplest and minimum of motions. We strive to eliminate all waste time. We scream when we see people doing any kind of rework. Then tell me why do we persist in what I call "rate setting." Why do we time the same elements of work over and over again?

Apparently, the majority of timestudy men contradict every rule in their book in doing their own work. They go about setting a time standard as though it were a special order. They set up for their timestudy as if there were only one piece on the order.

They work out the method for that one operation as if it were the only one performed in the shop. They timestudy a few cycles and set a "rate" with a finality that suggests either they never expect to see the operation again or they know it will continue that way without ever changing. We know perfectly well that none of these implications is true. Then why don't we take some of our own medicine and utilize some more efficient methods in our timestudy work? Why don't we utilize the standard method to set work standards?

MAIN ADVANTAGES

To begin with, the standard data method is much the cheaper way. It is about one seventh as costly, according to the one check I've been able to make. And that bears on the direct cost per standard. Regarding the relative indirect costs of squabbling, I have no figures. However, we do know that individually set "rates" must have more potential grievances in them. Much of this is overcome by the inherent consistency of standard data. In this vein of complaints, you can reduce those of the "lost opportunity" type because you can increase your incentive coverage with data.

You know already about these and similar advantages. So if I am to add anything worthwhile, I must develop some other angles. Six seem important enough to discuss briefly. All of these are obvious but you may not have thought of them.

BETTER TIMESTUDY

The first is that you must take better timestudies if you are to build standard data. Now don't take that as an insult. It's only an illustration of the common saying "what we don't know won't hurt us." Those who use the "rate setting" method simply don't know that their timestudies are poor. They are defective in two or three ways. First, they contain errors in rating. Second, they lack correct element break down. The third is part of the second. But I want to emphasize this variation separately because it bears on one of the major points I'll talk about later. Here, the third factor in timestudy is the burying of irregular work content in our so-called elements.

These three variables in the isolated timestudy remain undiscovered in the "rate setting" process. You won't find them unless you make comparisons. When you begin to compare element standards, you have stepped over the line into the data method.

Comparison of element standards is the basic step in the standard data method. It is this phase that brings out the variations. They show up more noticeably when you plot curves of your variable elements. I liken the plotting, and analysis that goes with it, to a go-no go gauge. Will your element standards fit the gauge? Experience says, "No." Take an everyday analogy. How could a man in the shop make two or more pieces of the same diameter without some measuring device? If he had calipers, but kept them in his tool box, how would he get the diameters to the same size? If he used his calipers, he could make all his pieces alike. But if he had no scale, they might be 6″ in diameter instead of 4″ or some other desired size.

From this shop example, you can see that you can't tell where you are without comparison. And you might think of the caliper as the measure of element content. The scale could be analogous to your performance rating. But you must use both to make pieces alike. I will go a step further and say, "In my opinion, a timestudy man is not qualified until he has proven that his results will plot."

FOOLED JUDGMENT

Notice I have not used the word accurate. I purposely chose caliper and scale to illustrate my point. Let's take another look at our scale. In the first place, none of us considers it a precision measuring instrument. But its basic measure is exactly the same as that used in our most precise measuring tools. Yet, where did we get the inch? Who says it's an inch? According to hearsay, our inch is the length of some ancient king's thumb from the joint to the tip. Purely arbitrary! I've heard it said that he chose the length to settle a dispute.

HIGHLIGHTS ON THE AUTHOR

Phil Carroll, engineer, author, lecturer and consultant, is well known to ADVANCED MANAGEMENT readers. He received the Gilbreth Medal for 1950. He is the author of "Timestudy for Cost Control," "Timestudy Fundamentals For Foremen," "How to Chart Timestudy Data," and "How to Control Production Costs."

*This paper was presented before the 1952 Management Conference of the University of Connecticut.

In our language, the rating scale can be based on an inch more or less according to our relax factors and our incentive plan. But you must use some scale to get element standards that will compare. In addition, you must have the same work content in your elements being compared.

At this point, I want to summarize my second distinctive value of the standard data method. You will agree that comparisons of things in motion require some common denominator like miles per hour or feet per second. Further, you will admit that you must find ways to gauge both distance and time. If the distance is fixed you can determine who wins a race with photos, watches or breaking a tape.

With stop-watches, usually several people time a race to get pooled results. That's because judgment enters the process. With performance rating, you have the same conditions. You have a normal pace like 60 units per hour or 100% and are trying to apply that measure to some unknown pace. Your only means of application is judgment. And in many "rate setting" departments that judgment isn't even trained.

Such "rate setters" would be forced into some kind of training if they tried to build data. With trained rating, you still have the variations. But again, like our diameters in the shop, these should fall within tolerance limits. When you have these conditions, I believe you get the closest to accuracy through the pooled judgments inherent in the data process.

In simple language, I describe standard data as the summarized results of many timestudies taken of many people by several observers. My suggested minimum of several is three. Obviously, more than three will add to your pooling affects in proportion. This is a most important advantage of the data method.

FAIR MEASURE OF SKILL

In this pooled approach, you derive another benefit that is my third point of emphasis. It also grows out of the method. It is what I call "the definition of normal skill." Actually, it is not a definition. It is more of a measure.

To start off, you know that job evaluation descriptions do not define normal skill. My guess is that they never will. Yet, we must go on hiring, training, paying and promoting people. We say promotions are "based on ability." But what is the yardstick? We say somebody earns too little or too much on incentive. How do we know?

Part of the too much or too little must be answered by rating. Is our rating correct? How is the person working in terms of our rating?

Mixed in this "working" is the factor of skill. Skill here excludes all forms of speed and refers to reduction of thinking, motion and elements. This aptitude for doing work with less motion varies with people. You see it when you study several doing like work. We say, "Everyone uses a different method." They do and they will, in my opinion, regardless of how you plan the work and train for uniformity.

Now the question is, "What method or skill should we expect of the normal qualified person? What elements should be allowed for in the standard?" Again, this is best answered, I think, by the pooled comparison of multiple studies. My belief is that we get the fairest "definition" of normal skill by the standard data method. If that is so, then standards based on data more fairly compensate for skills above those paid for in the base rate.

STANDARD METHODS

There is another angle to standards for method. This one is exceedingly important in cost controls. I'm so concerned about these uses of time standards that I've written a whole book on the subject.[1]

As an extension, you might say, of method standards for the employees, you need method standards for your company. These are a necessary foundation for correct cost control denominators. The easiest way I can explain denominator is to say your time standards must be equivalent to good pieces produced.

Take a simple example. Suppose you turn out parts on two different machines. One is faster than the other. Just a shade away from this is another example. You have two parts almost alike. One is made in large lots. You have a jig for drilling. The other is produced in small lots so you can't afford a jig.

If your standard times include these "inefficiencies," then you do not have a common denominator. If your standard is 2.0 min. on the fast machine and 4.0 min. on the slow one, you get only two pieces, not three for a cost of 6.0 min. Therefore, if you seek a correct cost denominator, you must show your "pure" standard as 2.0 min. in both cases. Let me put it the other way round. You would set the standard as 2.0 min. if you were setting it from a blue print before the job went in the shop.

COVERAGE OF IRREGULARITIES

These "standard methods" are a necessary part of setting standards in advance for job shop work measurement. But don't miss the important contribution they make to sound work measurement cost controls.

Now think of this from a different slant—mentioned earlier in connection with better timestudy. You would expect to get different watch readings or standards for different amounts of work. Walking 3′ would be more than 2′. Drilling 1½″ would be more than 1¼″. These variations are easily seen. That is because first, they are relatively large and second, I show them in numbers.

These same variations, often smaller in amounts, are in many elements we observe. Should we expect that element standards for unlike work content will plot? How do we know they are unlike if we don't plot them? Should we bury averaged conditions in our element standards? How broad should our averages be? How will we correct standards when we improve our average conditions? All this is by way of saying, "You can't compare horses and apples. You would have to better define your element content in order to build up good standard data."

To do so, you would have to have a "standard method" in mind. Now go on a step and assume standards for cutting speed and feed, thickness of stock, quantity in a box and hundreds of others.

In trying to make my fifth point, I'll carry on with this same phase of "standard method." Let me emphasize it further with common practice. Suppose, for instance, that your standard stock allowance was ⅛″ on a small casting. You get a call from the shop.

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1 Carroll, Phil. *How to Control Production Costs*, McGraw-Hill Book Co., New York, N. Y., 1953.

"This lot of castings is way oversize." So you take a look. You find there is ¼" to come off. If you set a "temporary standard" that includes the extra stock, you have destroyed the correctness of your cost denominator. Your cost department will apply overhead to that extra ⅛" of stock. It was wasted labor. It can't earn any overhead. And because you called it "direct labor", they charge overhead to it and thereby fail to charge that much overhead to your good production.

Of course, your mechanic should be allowed for any extra work he is required to do. But the extra work is indirect labor or overhead. However, my fifth point is that you can much more easily and quickly set standards for extras by the data method. As a result, you can greatly increase your coverage. I say greatly because "rate setting" coverage often bogs down around 40% of the total work time that is on standard. You should attain 95% or better.

Now for my sixth and most important phase. Management's most difficult task is looking into the future. I call it "crystal ball gazing." Decisions must be made. Frequently, there are no facts. Often, there can be no facts until we've gone through the period. Here, standard data can make its most valuable contribution. You can use it to predict the answers to many questions. These questions may not be the ones of greatest concern. I'm sure they are not. But to the extent you can answer some questions with facts, you reduce the load. Also you cut down the costs of "guesstimates."

With sound standard data, you can predict costs and savings to result from almost every kind of proposed manufacturing change. You can foretell the probable saving to be made with proposals for new equipment. You can figure the savings likely to result from changes in product design.

You can work up probable costs for pricing new work. We call this estimating. And when you can help your company determine ahead of time what their profit opportunities are in a new product they propose to bring out, you're near tops in estimating.

These are some of the important phases of standard data we seem to overlook. We get ourselves so involved in day-to-day standard setting that we are apt to forget the rest of our job.

I'm not minimizing the importance of setting work standards. As a matter of fact my experience shows that we only half do that part of our jobs. We must have standards on all operations. Also, we must have satisfactory incentive earnings on those standards. Without both, predictions can not come out right more than a fraction of the time.

My emphasis is not that we should neglect this basic function. It is that we should not only do it better but we should go way beyond it. We should improve our timestudy skills. One way is to utilize the standard data method to its ultimate. It affords ways to do both better timestudy work and much more of it. This has a selfish angle too. As I put it, "We are not entitled to a nickel more in pay until either we deliver more pieces or a higher skill." ★

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Increased Efficiency Through Production Planning

By D. B. KIRK

How the Chambers Works at duPont carries on planning for production.

HIGHLIGHTS ON THE AUTHOR

DeNard B. Kirk is Senior Supervisor in charge of Methods and Standards at the Chambers Works, E. I. duPont de Nemours & Co., Inc., Penns Grove, New Jersey. Since 1937 with Du Pont he has held various industrial engineering and training positions. He holds an industrial engineering degree from Penn State.

IN DISCUSSING "Increased Efficiency Through Production Planning," I believe we should first consider this question: For what purpose do we plan? This is a question which should be constantly kept in mind by those responsible for planning the operations of any business.

Certainly we must plan for the overall success of the enterprise—for the owners of the business who risk their capital for a fair return on their investment—for the employees who give their services for wages and salaries—and for the customers who deserve the fullest measure of value from products purchased.

In our American system of free enterprise, the profit motive is paramount; actually the justification for and the survival of the enterprise depends upon that motive. Planning can provide the necessary information upon which decisions are based that make possible this profit.

Production planning is primarily a management function and should mean pre-planning or the formulating in advance of all the various industrial factors vital to production. It must consider in advance the proper use of men, materials and machines and must establish the manufacturing techniques to be used. It determines what must be done as well as where and how to do it.

Broadly speaking, planning involves more than production control; it is the combined effort of many departments working toward a common goal. The Purchasing Department must see that the raw materials and supplies are on hand. The Maintenance Department must have the machines and equipment in proper working order. The Manufacturing Department must make sure that the equipment, manpower and tools are available, and transportation must supply the raw and essential materials and remove the finished product to storage.

DEVELOPMENT

It may be of interest to review briefly the development of planning techniques. Some years ago a Manufacturing Department consisted of a superintendent, and several section foremen, together with the necessary clerks. The superintendent would issue the orders and instructions for the work to proceed, depending on his organization to keep the proper flow of operations, so that the product would be completed on time and, he hoped, at a cost that would return a profit to the company. As manufacturing units became larger and more complex it became increasingly difficult for this system to function. As a consequence, the next phase in this development was the establishment of a planning section whose function was to relieve the direct supervision of the responsibility of production control. Schedules would be made out and expediters set up to follow the work through the processing cycle. The expediters would correct and adjust bottlenecks and would remove difficulties that arise. Although this procedure was an improvement over the old, it still did not, in many cases, plan for the elimination of difficulties before they occurred, nor did it give much thought to improving the methods of manufacturing; this was usually the prerogative of those responsible for doing the work and in most cases based solely on past experience. To this point in the evolution of planning, very little thought or effort was made to pre-plan, to pre-analyze or to pre-determine the desired results. The next step and one which is being rapidly developed today is the establishment of staff groups, made up of special talents to assist the line organization, to effectively and efficiently manage and control all phases of the production. At this time engineering principles in the form of recorded data of proven background entered the field of production planning. These principles are time and motion study, methods analysis, work simplification and others. For the first time those responsible for production had available information, validated by established facts, on which to base their decisions; these have proved far superior to the use of their past experience.

The phase of Production Planning which we shall discuss is the establishing of the proper sequence of operations and the necessary controls for their

completion, that will cause each operation to be performed in a stipulated manner at a designated time for an acceptable cost. This is usually a major responsibility of the operating department, frequently assisted by staff groups such as a Methods and Standards Group.

METHODS AND STANDARDS

A Methods and Standards Group contributes to increased efficiency by developing the information and controls necessary for proper planning. Such information will, to a large extent, depend upon the industry in question and the product to be manufactured. In a continuous process industry where the raw materials enter one end of the factory and flow through in a steady stream, the required tools, their refinement and use will vary from the multi-product industry, and this again will vary, when planning for service activity such as plant maintenance. However, I shall present a few broad requirements which I believe are common to good planning regardless of industry or product.

1. *Trained personnel*—certainly you must have the correct number of qualified operators and supervisors trained in all the aspects of the job at hand and capable of handling the machinery and equipment in a safe and efficient manner.

2. The most efficient method or sequence of operations to do the job should be developed.

3. Operating instructions, preferably written, should be developed and issued to all concerned.

4. Machine output or equipment capacity must be known.

5. Routing and scheduling procedures should be defined.

6. Inventory records of raw and essential materials must be accurately maintained on a current basis.

7. Standard time values for each of the operations of the cycle must be determined.

Keeping these basic requirements in mind, I shall outline to you the activity of this Group at the Chambers Works of the duPont Company. But first I would like to acquaint you with our Plant.

The Chambers Works and Associated Units is a large Chemical Plant normally employing approximately 7,000 people. Here are produced some 3,000 organic chemical products, with operations varying from the continuous process type to the batch process or job lot type. This Works occupies an area of about 460 acres, containing some 550 separate buildings. The transportation of essential materials and finished products involves the use of some 10 miles of roads, 14 miles of standard gauge railroad track and 12 miles of narrow gauge track. The Chambers Works proper is composed of two large general production departments. To service these manufacturing areas there are five other departments; namely, Engineering, Stores and Transport, Accounting, Employee Relations and Development. Also located at the Chambers Works and known as the Associated Units are four large Technical and Research Laboratories and a Chambers Works Construction Department.

The Methods and Standards Division, which I represent, is a division of the Employee Relations Department. This division has five major phases of activity; namely, Production Methods and Standards, Engineering Methods and Standards, Special Methods Studies, Control, and Work Simplification Training. With the exception of Work Simplification Training which operates on a scheduled conference basis, these activities are integrated with the staff and line organization of the Plant by assigned key Methods and Standards Engineers who are set up to coordinate the Methods and Standards Program of the various general plant areas.

This program has the following general objectives:

1. To develop improved methods of doing work,

2. To provide labor standards for labor cost control, and

3. To provide incentive for increased labor productivity.

WORK SIMPLIFICATION

In recent years with labor and material costs rising and selling prices fixed by competition or by control, it has been important that cost reduction programs be emphasized to keep plants in a competitive position.

In our plant, production planning and cost reduction is a line organization responsibility. In order to assist line organization to carry out its responsibility for improvement of work methods, a Work Simplification Training Program has been instituted. This program is based on the principles and techniques developed by A. H. Mogensen some years ago, with which many of you are familiar.

We define Work Simplification as the systematic application of common sense to find easier and better ways of doing work. The objective of our program is long-range and is not satisfied by the accomplishments resulting from the jobs studied during training. The program is designed to enlist the cooperation of all employees in improving work methods, and emphasis is placed on better planning to reduce costs by doing more with what we already have. Each person is trained to develop time and labor savings methods and to put that thinking into operation. Our Work Simplification Training Program furnishes supervision with a simple formula for analyzing jobs and making improvements.

Methods Engineers are assigned full-time to training plant supervision in Work Simplification techniques, and they hold classes of from eight to ten persons. The full-time Methods Engineers help the members of the classes to study their jobs. The training program is designed to assist line organization in developing a questioning attitude on the part of supervisors and foremen, and gives them a method for exploring the steps of any job to determine if they can be eliminated, combined and simplified. This training period consists of six two-hour sessions spaced at weekly intervals. The trainee selects his own jobs and proceeds through the steps of the program, under the direction of the Methods Engineers. He uses Work Simplification principles and techniques, such as flow charts, flow diagrams, multiple-activity charts, work distribution sets and multi-column charts. The program recognizes that resistance to change and resentment of criticism are great obstacles to progress, and it shows ways of getting acceptance of new ideas.

After the trainee has received his 12 hours of training and returns to his area, he first completes his initial project selected for study during the program. Upon completion of this project, he then begins looking around for other jobs to study. He does this because each area within the plant has an organized cost reduction program. Each foreman,

supervisor, and other key salary personnel is, on a systematic basis, expected to and does select jobs to study for improvement. The follow-up program in the areas are a line organization responsibility.

The general pattern for job improvement includes the following key points:

1. Select a job to study.
2. Break down the job into elements, using a flow process chart.
3. Question the job and each detail of the job:
   (a) develop a five step question approach - what - when - where - who - why.
4. Develop a solution or improved method:
   (a) eliminate - combine - change sequence - simplify.
5. Look for the safety hazard spots.
6. Put the improvement into effect.

LABOR MEASUREMENT

In my opinion, labor measurement based on time study is a pre-requisite when planning for the effective use of labor. In fact, in order to establish labor standards many other factors of the business are made known, such as: methods of operation, equipment capacity and utilization, dovetailing of operation for proper sequence, loss of time due to bottlenecks and reasons for equipment downtime. Actually a study for the labor requirement of a job, by necessity, is a review of the entire planning program. It will expose any inherent weaknesses, and through analysis will materially aid those responsible for the efficient processing of the product.

We might list a few specific advantages to be derived by the use of labor measurement in production planning as follows:

1. It will establish the content of a fair day's work, or what should normally be expected from each individual for his day's pay. It is then a goal which supervision should expect for money spent.

2. It will serve as a yardstick and when correctly established, supervision may schedule their men's activity accordingly. It permits scheduling the day's work with a minimum of lost time between jobs.

3. It is a basis by which to establish and evaluate the proper methods of doing work. We might know of alternate ways of doing the same job, but without a yardstick, how do we know which is the most economical?

4. It is a basis by which to forecast labor requirements and establish standard crews, when the workload is known.

5. It is a basis on which to forecast labor costs in advance or to quote prices for services rendered.

At the Chambers Works, labor standards are used in conjunction with a wage incentive plan. Standards are developed for jobs, and employees are remunerated over base pay, for attainment of a performance better than normal. It is generally agreed that standards reach their maximum of usefulness when associated with an incentive plan. They can, however, when used alone, increase the performance of a department substantially. So, except for degree, standards without the incentive plan can materially reduce and control production and service costs through planning.

At our Plant, labor standards have been developed for production employees, maintenance mechanics, laboratory technicians, stores and transport personnel and construction employees. These include all of our wage roll people, with the exception of those engaged in office and clerical activity. Except for Maintenance and Construction, our labor measurement is developed in terms of units of work per 100 pounds of production for each of the 3,000 products manufactured. The make-up of these standards involves the use of some 17,000 individual unit labor standards and an infinite number of work elements. This is the best method we know by which to forecast the necessary operating labor for any given make up of production, or the proper planning of activity for efficient labor utilization. Labor measurement serves as a basis on which to distribute operating labor costs between products being produced concurrently in any given operating building. It also establishes operating labor cost standards, on a uniform basis, between the different operating units or areas. Only in this way can labor cost efficiencies between production areas be made on a comparable basis.

Finally, labor measurement is used to provide a basis for financial incentive for increased labor productivity. We have, at present, about 180 separate wage incentive installations. The average incentive earnings amount to approximately 15% of the base wage roll for those covered by the plan. Productivity per man hour has increased from 35% to 50% above the levels obtained prior to the establishment of labor measurement and the use of incentive.

I shall give you a typical example of how one of our production units employs labor measurement in its production planning. This area produces approximately 600 different products during a year and, in any one given month, may produce as many as 200. The area supervisor, as well as all others, receives forecasted production schedules well in advance of actual production. He receives a yearly forecast which lists by products the expected tonnage for the coming year. In addition, he receives a monthly forecast which states the actual requirements for the coming month. By the use of labor measurement, he determines the crew size necessary to manufacture the desired production. For final scheduling, labor standards on a weekly, daily and sometimes individual basis are used to insure proper dovetailing of operations, complete equipment utilization and effective use of labor. He uses the labor measurement to establish operating labor cost standards, and for labor cost distribution in pricing out the cost of production per product. The standards are further used as a basis for incentive premium to the operators for performance above normal. By using standards in this way, in the area, operating labor costs have been reduced over 30%.

The Supervisor in charge of this production unit recently told me that before he had labor standards available to him, he thought he knew what a day's work was and that his operators were effectively busy. He further stated quite frankly that, since using labor measurement for production planning and cost control, he is convinced that he could not operate his plant efficiently, labor costs wise without these. It is impossible for him and his supervision to know the content of a day's work in a multi-product unit.

MAINTENANCE & CONSTRUCTION

At the Chambers Works there are approximately 900 mechanics engaging in minor construction work and maintenance of the operating facilities.

We have found that the pre-analysis plan for maintenance and construction jobs of 16 hours and over is a practical approach to controlling maintenance and construction cost. Pre-analysis, to us, means to pre-determine the proper method for doing a job and to establish the labor cost prior to the start of the job. We find that pre-analysis of maintenance and construction work will accomplish the following:

1. *Assist In Determining The Proper Method For Doing A Job*

This is accomplished by requiring Engineering Supervision and Methods and Standards personnel to visit the job site, prior to the start of the job, to determine the safe, practical and economical method for doing the job.

2. *Aid In Planning And Scheduling The Job*

Since it is a requirement for both Engineering Supervision and a Methods and Standards Engineer to visit the site, a maximum of pre-planning occurs. After the job standard has been established by the Methods and Standards Engineer, a manpower requirement sheet is furnished to all Engineering Supervision involved, giving in sequence an outline of each craft's work and the estimated hours allowed to complete the work.

3. *Provide A Standard Time By Which Performance Can Be Measured*

Job standards are developed by the application of basic labor standards established from time study.

4. *Gives Craftsmen Working On A Job A Feeling Of Achievement By Meeting Or Bettering The Goal Standard.*

START-UP PROGRAM

Another tool designed for better planning is what we call a *start-up assistance program,* which is a planned approach in analyzing layout, establishing standards, planning, scheduling and coordinating completion of construction, testing of equipment, training of personnel and putting equipment into operation. The object being, to organize plant start-up so that operating effectiveness from the beginning will reflect minimum operating cost, based on predetermined standards of operation.

A start-up program is fundamentally based on the development of equipment layout charts, operating procedure manual and process flow diagrams. Man and machine charts are prepared to show estimated manpower requirements and job assignments. Operating manuals, training information, schedules for training and placement of personnel, schedules for testing equipment and initial production schedules for operations and maintenance are also prepared. Essential standards are developed for yields, quality, labor and special safety features.

A start-up program may be expected to:

1. Establish manpower requirements and assign proper work loads to each man,
2. Assist in developing improvements in design and layout,
3. Reduce material handling costs,
4. Allow for effective space utilization,
5. Provide for a continuous flow of work,
6. Eliminate the hiring of excess personnel for the plant start-up by the establishment of standard crews,
7. Reduce the cost of training, and
8. Facilitate reaching optimum operating effectiveness at a very early stage.

Experience has shown that in most cases, when starting new facilities, operating difficulties create delays which tend to lower the production rate, cause higher labor costs and, in general, decrease the efficiency of the starting unit.

By planning for all foreseeable production elements in an orderly fashion, prior to start-up, supervision can give full attention to the unknown elements during start-up. Experience has shown that, with this planning and training program, savings will result from the elimination of excess operating maintenance, laboratory and office labor. Also, additional profit can be attained by reaching production capacity sooner with reduced training costs. Such organized programs have been used at the Chambers Works and elsewhere in the Company. We believe that, by starting an operation with the proper size crew, thus eliminating force reduction at a later date, labor grievances are prevented.

Chambers Works experience has shown that the average time required to reach a normal labor effectiveness is 28 months after the start-up of a new facility. With the use of a start-up assistance program, this time interval has been closed to about 15 to 18 months.

Limitations and failures commonly encountered are:

1. The failure to recognize that planning is a continuing process, calling for periodic adjustment of technique and relationships.
2. The tendency to over-elaborate which often does not stop short of trying to make provisions for every possible contingency.
3. The inability to acknowledge that there are limits beyond which planning can be developed, resulting in diminishing returns.
4. The unwillingness to accept that all plans are subject to human execution and therefore, must at times be temporized.

SUMMARY

A philosophy to practical production planning should be based on the following concepts:

1. To adhere to the substance of planning rather than to worship the form in which it is cast.
2. To view production planning as merely a means to an end and not an end in itself. Planning should be adapted to the type of manufacture involved; rarely should the type of manufacture be varied to conform to the planning procedure.
3. Be flexible with your plans and alter them immediately, if that will accomplish the desired results.

It may be said that planning embodies many functions which may be decentralized by assignment to line organization aided by staff and service groups, or may be centralized under a specific planning group. But regardless of organization, those responsible must have the imagination and perception to pre-plan, to pre-determine, to analyze in advance the factors essential to production.

Let us, in the days ahead, treat production planning as a continuing program with new developments and improvements in techniques, so that in our small way we can contribute to the advancement of our system of free enterprise. ★

A Word On The Rating Films

By V. A. FLYNN, Ph.D.
Research Director, SAM

Motion picture instrument evolving from nation-wide research by SAM is gaining wide acceptance as an effective training and refresher device in the determination of a "fair day's work."

THE SAM Effort Rating Films appear to be establishing themselves rapidly as one of the really major contributions to the fields of time study technique and wage incentives. Twenty-one universities, here and abroad, presently are using the films as teaching aids. Virtually every type of industry is using them throughout most of the United States, and in Canada, South America and the free countries of Europe. The demand for them continues to grow; and their efficacy as a short-cut training method for new personnel in time study, as well as a refresher for seasoned practitioners, continues to receive acclaim wherever they are in use.

The Effort Rating Films are the product of ten years of intensive research under the direction of the Rating Committee of SAM, in coordination with The Research Division of the College of Engineering, New York University. Approximately 15,000 man hours were spent in study, collection and analysis of data. This does not include the man-hours of some 1800 industrial and time study engineers, from over 200 companies, who participated in rating the films.

The objectives of the films are well summarized in The Rating Report—a monumental document evolving from the data of the film research, and presently being prepared for publication by the Management Research and Development Division of The Society for Advancement of Management:

1. To establish bench marks of operator performance for a number of operations exemplifying a broad range of industrial work.
2. To judge the extent to which the concept of proper performance in any organization may compare with the concept used in industry generally.
3. To provide an objective frame of reference by comparing the bench mark with unknown or disputed performance, after selecting a film of operation with greatest similarity.
4. To provide sources of standard data, or fundamental motion-time values, or to check existing values.
5. To provide a comprehensive procedure for instructing time study trainees in rating and for measuring the results of such instruction.
6. To provide a follow-up procedure that will insure that the time study observer's concept of proper performance will remain correct, and that he will retain the ability to evaluate a rather broad range of observed performances within reasonable limits of accuracy.

The experiences of film users to date would indicate that these objectives are being fulfilled quite to the letter.

The Rating Films are composed of eight, 16 mm. reels, each reel depicting alternately three separate operations performed at five different operator speeds. The types of operation range from finger dexterity to total body-movements. Consensus ratings are given for each performance under varying combinations of work-allowance and premium expectancy. Forms are provided whereby trainees can record and plot their own ratings against those of 1800 experienced time study personnel. A manual of instructions, which also describes the dimensional and physical components of the separate operations, is provided with the reels.

Following are the operations depicted in each of the reels:

Reel One: Deal Cards; Transport Marbles; Toss Blocks.
Reel Two: Dink Tile Squares; Fold Gauze; Pack Gaskets.
Reel Three: Countersink; Kick Press; Shear Rubber Tile.
Reel Four: Form Rug Cups; Cut Cork Tube; Deburr.
Reel Five: Shovel Wet Sand; Stack Cartons; Feed Rolling Mill.
Reel Six: Tape Boxes; Seal Cartons; Pack Cans.
Reel Seven: Bolt Flange; Fill Car Radiator; Check Tires.
Reel Eight: Collate Papers; Staple Papers; Tear Bills.

At the present time, the eight reels are sold only *in toto*, for $495.00. There is no provision for the distribution mechanics that would be required to rent them, or to sell them fractionally; and plans for such provisions are not in the immediate offing.

There is every reason to feel confident that the ten years of painstaking work which culminated in these Rating Films will prove increasingly to have been one of the most fruitful decades of research in the history of industrial evolution. The time is indeed ripe for further research that will point the way and provide the techniques for greater happiness, comfort, security and strength through increased productivity among the free peoples of the world. ★

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Professional Management — Fad or Philosophy?

By K. O. WILLIAM SANDBERG

Looking ahead toward the further development of the industrial engineer.

THE TIME has already arrived when graduate industrial engineers who are broad-gauge thinkers take on the functions implied by the terms of scientific management, management engineering and professional management. Why scientific, why engineering and why professional? Is this just another tricky combination of words? Let us consider what is involved.

The first two terms imply that management may utilize the concepts and methods of science and engineering. In truth this is so. Management has been functionalized and further sub-divided. Each has its specialists. Plans and policies are made upon the recommendations of such groups. The resulting experiences have been measured. Many of the better solutions to problems are becoming known and recorded. Handbooks are starting to appear in which empiric results for many conditions are tabulated. Organized research, sometimes well financed, is probing the more difficult situations. The Society for the Advancement of Management has established a research committee and a research program. All groups seem to find much worthwhile information by just collating the scattered data already in existence. Patterns seem to emerge from analysis of such collations. Such patterns give rise to new theories or support older ones. The patterns are occasionally sufficiently evaluated numerically as to permit vigorous translation into mathematical expressions. The newer concepts of statistical variations are included.

Finally, we have yet to see the ultimate transformation of mathematical exactness into mechanical and electronic devices. However, this is not blue-sky thinking. The "Electronic Brain" was used recently to predict the election results based on the first 2% of returns. The interference computer built several years ago by Professor Dale Jones grinds out answers on machine interference for any set of input conditions.

HIGHLIGHTS ON THE AUTHOR

K. O. William Sandberg is President of the Hudson Valley SAM Chapter and a member of the National Research Committee on Management. He is Manager, Industrial Engineering, Chemical Division, General Electric Company, Pittsfield, Mass. He holds a Doctor of Engineering Science degree from New York University.

The prevading characteristic of all these data, patterns, equations and devices is that there is a reproducible answer which is reasonably consistent for the same set of original conditions. This is the very essence of the scientific method and the engineering approach.

In the future, management may anticipate results when conditions are manipulated in accordance with these established patterns. There will be less art and instinct required. There will be fewer business failures.

Initially, however, it is inevitable that human judgment will be imposed for awhile until confidence in the scientific method is established beyond all doubt. Then there will be the period of a new breed of "Efficiency Exports" who misapply and misuse the newly established methods — and with disastrous results —leading to an interim period of skepticism again. History will surely repeat itself.

The cast of distinguishing between management, art or rule-of-thumb versus scientific or engineering, is quite clear. There remains an explanation of "professional" management.

CODE OF ETHICS

The "professional" terminology seems to have its reasons for existence tied to morality. A review of other so-called "professional" groups or societies reveals only one common characteristic —devotion to a code of ethics. A moment of reflection leads to the conclusion that this is a sequel to any set of management methods, whether scientific or not. The professional "concept" deals more with the legitimate objectives of management's effort. It enters the realms of social and political goals. It impinges on government. It deals with abstract but none the less real ideas concerning honesty, equality of opportunity, justice, etc. It, therefore, incorporates many of the democratic and Christian ideals into commercial and industrial objectives. That there could be a Ten Commandments for Professional Management is not unrealistic. In fact the SAM research committee is already at work on such a project.

The term "professional" management has also come to acquire an additional meaning related to scientific management. This is probably best described as the type of management practiced by those who are serious students and practitioners of the principles and methods of the scientific management movement. In this context, the term professional seems to include a social code of ethics as well as the scientific and engineering aspects—and as such is all inclusive as a result of general but not too strict usage. ★

Remarks Of Acceptance On Receipt Of The Wallace Clark Award

By ERWIN H. SCHELL

ABOUT THE RECIPIENT

Professor Erwin H. Schell is Head, Business and Engineering Administration, School of Industrial Management, Massachusetts Institute of Technology. He is an outstanding author, consultant and speaker; active in many professional societies, including SAM; and has long been a leader in the international management movement.

Front and back views of Wallace Clark medal.

EDITOR'S NOTE: Professor Erwin H. Schell received The Wallace Clark Award at the Annual National Management Council Dinner, January 14, 1953. This award was established by the Society for the Advancement of Management, American Society of Mechanical Engineers, American Management Association and the Association of Consulting Management Engineers. Professor Schell's remarks, following the presentation of the medal to him by Mrs. Clark, were so stimulating and thought-provoking to SAM members attending this Dinner that it was felt his speech deserved wider dissemination.

FOR MANY years, Wallace Clark has been an inspiring example as well as a valued friend to me.

In 1933, when the Massachusetts Institute of Technology initiated the first student tour of European industries, it was Wallace Clark and Mrs. Clark who were the first official greeters upon the arrival of the group in France. Their welcome will never be forgotten.

The quality in Wallace Clark which was always most intriguing to me was his invariable calmness and serenity. I have come to believe that this quality was the outer reflection of deep convictions within him. His every professional thought and action seemed to be buoyed and maintained by an unshakable faith in the unfailing power for social good to be found in enlightened management concepts.

I find interesting support for this thought in the following quotation from a book of Mrs. Clark's with which I am sure you are all familiar:

> ". . . I am reminded of the time in Warsaw when a Director said to his Board that he believed in the American methods as he did in God; and as they told me about it, I saw that was how Wallace and the Polish engineers believed in them too."

His high sense of responsibility to his calling and his important contributions to his profession will always remain an inspiration and a challenge to me.

THE NEW COMMERCE

In the brief time allotted, may I speak of an unusual development now taking place in the industrial world about us? I refer to what might be called a kind of international commerce, a far-flung, flourishing exchange of ideas about better management.

Such a commerce of ideas is, of course, not new. For many years, concepts relating to management theory and practice have flowed in considerable volume from one country to another. The many international congresses held under the auspices of this world-wide organization, since their inception in Prague in 1924, are but one illustration. The work of such progenitors in foreign fields as Wallace Clark provided other significant avenues of exchange. Recently, however, this commerce has been accelerated by the presence of new facilities and resources until its magnitude has made it one of the most striking industrial phenomena of our time.

THE NEW VEHICLE

The vehicle for these tidal movements of administrative thought has not been primarily the written word. Rather it has been word of mouth. During recent years, under the auspices of the Mutual Security Agency and the National Management Council, large numbers of industrialists from foreign countries have visited our shores, seen with their own eyes the day-to-day application of American managerial principles, and

talked at first hand with the top management of our industries.

Simultaneously, our men of management have been visiting manufacturers in other lands, learning of their points of view and procedures, and in turn have met with many European industrialists to compare these principles and practices with those of the United States.

THE NEW IDEA

We, who have fortunately been in position intimately to observe the development of this new commerce in ideas, have learned many interesting things. We have long known that ideas may most readily be translated into action when they are cradled in friendly attitudes. Somewhat more recently we have discovered that the warmth of our reception to new ideas is greatest when we may impersonally observe them translated into action and thus can personally judge of their effectivenes.

Now we are discovering that our acceptance of new concepts is further accelerated when we may examine them in company with others of our own turn of thought and national background, with whom we may discuss what we are seeing. We are finding that these methods of furthering the acceptance of advanced standards of good management are particularly effective in higher executive levels. Industrial leaders tend to trust their eyes and, to a lesser extent, their ears or their reading glasses when dealing with innovation. Seeing is believing.

Finally, it is becoming clear that constructive action at home, following upon observations in other countries, is more readily awakened in those not so fortunate as to have seen with their own eyes, when the practical worth of the ideas thus imported is testified to by a group of witnesses rather than by a single Marco Polo.

THE NEW STIMULUS

The crucial importance to all of us of unity in the free world properly lends strong if not dominating stimulus to these international exchanges. Yet, such mutually beneficial give and take of managerial ideas is founded upon more than contemporary world conditions. It builds upon deep subjective bases of affection for our foreign friends. We do not forget that our ancestral roots reach back to these nations which to us are true motherlands. Conversely, the never-failing hospitality and friendliness to us of the peoples of free countries is attested by the tens of thousands of our nationals who as tourists visit these countries each year.

THE NEW OPPORTUNITY

My hope is that we in the United States may remain not only awake to the great opportunities for strengthening international relationships now laid at our doors, but that we shall foresee and prepare for those future opportunities which less clearly but no less importantly loom before us in order that we may act with greater wisdom and statesmanship in the days to come.

A vital contribution to the distant future will be the early education of the youth of the free nations in the ways of creative industrial administration. It has been said that we cannot control the present without planning the future. Likewise, we may not safeguard the future without preparing in the present to deal constructively with it.

One of the qualities which we must reawaken, nourish and strengthen in the coming generation is that pioneering spirit of adventure which had so much to do with the development of our own country. While man has crossed most of the earth's geographical frontiers, that does not mean that there are not unlimited opportunities for exploration and discovery yet before us.

There is still adventure in rich measure to be found in the United States. Our frontiers, while no longer geographical, are steadily advancing in the realm of the sciences. It is interesting to note that the products of one of our most progressive industries carry the names of some of our greatest adventurers of the past: Cadillac, La Salle, DeSoto.

There are those who are concerned with the lack of this spirit in the youth of our time—those who feel that too many young men seek jobs today on the basis of security—pensions, insurance, continuity of employment. Be this as it may, I am assured from a knowledge of the European lads who have visited this country and of our own students at Technology, that there are in the older countries as well as in the United States, many young men in whose breasts the fires of the pioneer still burn.

A fascinating challenge lies before us in the United States—that of extending to the nations which stand with us for freedom, opportunity for their younger generation of potential managers to come to our country for extended stays and to learn at first hand of the spirit of creativeness, of organized adventure, of scientific pioneering, no less than the method which underlies the profession of modern management in the United States. Our more than 200 colleges, schools and departments of business administration should have no difficulty in absorbing annually up to 5,000 of such young men for year-long sojourns to our country incorporating study in residence and collateral experience in industry. The constructive effect of such a commerce carried on during the next decade with those soon to hold positions of leadership in friendly nations cannot but be profound.

CONCLUSION

I trust and pray that we may not falter as we face this extraordinary opportunity to further and to assure the future growth of this new and promising flow of administrative ideas throughout the free world which is of such superlative import to us and to the generations which follow.

Perhaps in this way we may reciprocate in some small degree for the immeasurable cultural contributions which the Old World has made over many years to the youth of the United States who have been so fortunate as to have visited or studied within the environment of those countries from which their forebears came. ★

MOVING??

If you are going to move, be sure to notify us as early as possible, preferably five weeks in advance. Send us your old and new address, with zone numbers, if any, by letter, card, or post office form. Also, notify your local post office of the change. This way you will continue to receive your copies of ADVANCED MANAGEMENT without interruption.

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On A "Salary Basis"

By LOWELL F. JOHNSON

This is the second in a series of articles dealing with managerial aspects of personnel administration.

HIGHLIGHTS ON THE AUTHOR

Lowell F. Johnson is Assistant to the Vice President, Industrial Relations, American Home Products. An authority in labor relations and personnel administration, he is a special lecturer at Rutgers, Columbia and New York University. He is a member of the National Labor Panel American Arbitration Association and President, New York Industrial Relations Association.

FOR SOME time now the Federal Wage and Hour Administrator has made it clear as to what is meant by "salary basis." He has emphasized that under the terms of the Fair Labor Standards Act employees exempt from coverage as Administrative, Executive or Professional (but not including outside salesmen) are on a salary basis, only if they receive full salary for each week in which they perform *any* work. Failure to establish the employment arrangement or company policy for such employees to the end that illegal deductions could be made from their salary, means loss of exempt status and possible heavy overtime liabilities for the period during which such deductions could be made.

Now, just to demonstrate that bureaucracy is not dead, the Administrator lowers still another boom. This, at the behest of two management organizations who asked for clarification and, who, it turns out, might almost have been better advised to remain silent. The question dates from a ruling contained in a letter dated May 24, 1951, in which the Administrator stated that the exemption under Regulations, Part 541, is lost if the employer deducts from, or offsets against, the employee's salary sums received by the employee as benefit payments under a disability insurance plan, fees for jury duty, or military pay while on leave.

RULING MODIFIED

The above ruling is now modified to permit military leave pay, jury duty, and witness fees to be deducted from regular salary without loss of exempt status. However, disability insurance benefits may be deducted from regular salary only to the extent that the benefits are paid for by the employer.

It is contemplated that no enforcement action will be taken by the Wage and Hour Division with respect to employers who have made deductions or whose leave plan or policy would have permitted deductions to be made from salaries of employees, if the employer conforms his plan or policy to the regulations by April 1, 1953, and reimburses the employees for the amounts of the deductions which he has made. Such liabilities under the appropriate statute of limitations run for a period of two years.

You should clearly bear in mind that this new ruling concerns only weeks in which *some* work is performed and does not in any way affect weeks in which *no* work is performed. The initial and terminal weeks of employment and fractional weeks involved in an *extended voluntary* leave of absence also seem to be exempt from the ruling. In such weeks, the payment of a proportionate part of the employee's salary for the time actually worked will meet the requirement of the ruling.

The Administrator indicates that the meaning of "On A Salary Basis" is still under study, and further changes in the regulations concerning deductions made from salary pursuant to such items as established leave plans may be in the offing. ★

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The Management Bookshelf

The Range of Human Capacities, Second Edition, by DAVID WECHSLER, Ph.D., published by The Williams & Wilkins Company, Baltimore, Md., 1952.

Many of the functions of industry depend upon the fact that there are fairly uniform limits to the range of human effort as expressed in relative rates of productivity. If this were not so, there would be a "wild" area that would make it impossible to operate even the most rough and ready piecework system. This has been vaguely realized in the past but probably without understanding of the implications or of the possibility that there may exist natural "laws" governing the situation.

THE RANGE OF HUMAN CAPACITIES, going beyond the accepted statistical facts of the normal frequency distribution curve, shows that in physical measurements, in physical actions and to some extent in mental capacities, there appear to exist quantitive ranges of such uniformity that they can be banked on in most cases of physical effort.

EXPANSION

In 1935, the first edition of Dr. Wechsler's book was published and was read with great interest by many, including this reviewer, who found it stimulating as well as useful in considering the problems and structure of time study. The new edition is an extension of the first with an added chapter on "Range in Productive Operations," and amplification of the examples used to support the thesis.

Although the book was not written specifically for industrial engineers or businessmen, it, nevertheless, contains chapters of especial interest to those who lean towards speculation on the underlying principles of human performance in the field of industrial production. In the process of explaining and documenting the facts that govern the range and distribution of human capacities, the author includes penetrating observations. To the industrialist, the conclusions are of profound importance and the observations are well worth contemplation. In regard to the latter, Dr. Wechsler's remarks on the subject of measurement—genuine and spurious—should be studied by all industrial engineers. Time study men will be greatly taken with the scientific confirmation of the basis of much of their practice as they read the extensive tabular matter and the logical interpretations thereof.

SUBJECTS OF INTEREST

The general reader will find much stimulus and enlightenment as he reads the chapter on "Genius and Deficiency," and "The Effect and Burden of Age." These subjects also are of interest to the industrialist who must deal with the problems of the advancing age of employees, and must understand something of the relationship between the rules upon which production must be based and the human exceptions to these rules.

Dr. Wechsler is to be complimented on a book which combines scientific treatment with readability, to form what one must believe to be a unique contribution in the field of understanding of human abilities and capacities, from both a theoretical and a practical standpoint.

RALPH PRESGRAVE
J. D. Woods & Gordon, Ltd.
Toronto, Canada

The Development of Executive Talent, by JOHN W. RIEGEL, published by the University of Michigan Press, Ann Arbor, Mich., 1953.

Executive talent is becoming an increasingly scarce commodity. With capacity production the rule and expansion a continuing challenge, there is a wide-spread search for top administrative brains that can plan, organize and energize. Evidence that this quest has not been productive enough is seen in the increasing number of companies which have given up the simple expedient—that of hiring talent in the market place, and are following the long and laborious process of developing executives from within the organization.

Sub-titled "A Survey of Experience in Fifty American Corporations," the volume summarizes the progress that has been made in an activity which has been of concern to executives ever since the first corporation for the production of stone arrow-heads was formed. On the solid foundation laid by such pioneers as Lawrence Appley and George Corless, there are now being developed practices and procedures slanted to the special needs of individual companies. Interesting as it is to see how many variations on the theme emerge, it is encouraging that Dr. Riegel has been able to pick out broad areas of agreement. These will be of greatest service to the newcomer in this field as he proceeds toward an understanding of the art of building executives.

FACE-TO-FACE

Much of this study examines the relationship between a superior and the man reporting to him. This is as it should be. For, only by sitting down with a man and talking to him can the superior do an honest job of appraising and reviewing his performance, helping him work out a plan for improvement, and coaching him so that he gets most good from the effort both he and his boss expend.

This book is tentative at times be-

cause much of the work that has been done in this field is tentative. Some of its conclusions are arguable because they are being disputed in practice. While we learn that these programs will develop men who perform better on the job, who lead and supervise more effectively, and are more flexible and versatile, we fail to discover what plans are being made to train executives to take over the tasks of social as well as business leadership in the future.

MANY QUESTIONS

Questions raised in this study are manifold. The consensus of the firms interviewed gives answers to such problems as: What are the good and bad points in the various procedures now in use for appraising executive performance? When do psychological tests fit into the picture? What are the best age ranges for trying out men of exceptional promise?

An appendix of value is a Demonstration Interview by L. Clayton Hill and Arthur S. Hann, both of the University of Michigan. This section illustrates the application of nondirective counseling techniques to the problems of counseling executives.

THE DEVELOPMENT OF EXECUTIVE TALENT is a valuable book to any business executive. For readers who have tired of generalities and are beginning to look upon panaceas with suspicion, this volume offers the kind of specifics that will be of help.

LOUIS A. ALLEN
Personnel Manager
Joseph Seagram & Sons, Inc.
New York, N. Y.

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Student Chapter Activities

American University. Mr. A. H. Hobelman, of the Walter Kidde Company, spoke to the chapter recently on the subject "How Business is Represented in Washington by the Company Representative."

Butler University. The chapter heard Mr. Milo Haffner, Personnel Consultant, speak on the topic "Failure of Executives."

DePaul University. James S. Perkins, President of the Chicago SAM chapter, spoke at the annual student chapter banquet. Earlier this year, the chapter toured the Ford Motor plant.

George Washington University. Mr. Trullinger, of the International Business Machines Company, spoke to the chapter on "Cost Reduction Through IBM Installations."

Indiana University. Wayne G. Broehl, Jr., has succeeded E. G. Williams as Faculty Advisor.

Lawrence Institute of Technology. The chapter met with the Detroit SAM sponsoring chapter to hear Mr. James E. Newsome, Vice-President, Chapter Operations, talk on "What Every Industrial Engineer and Personnel Man Should Know About SAM."

Northeastern University. The chapter toured the Gillette Safety Razor Company plant. At a recent meeting, the chapter heard Mr. Warren Conn, Quality Control Manager, Hood Rubber Company, Watertown, Mass.

Ohio University. Dr. E. T. Hellebrandt, Faculty Advisor, talked to the chapter on "Work Simplification." Mr. Elmer Fait reported to the chapter on his attendance at the Fall SAM Conference in New York City.

Oregon State College. The chapter heard Dr. C. A. Mockmore on the subject "Strategy in Handling People." Dr. Lillian Gilbreth spoke before the chapter at their February meeting. The chapter has also made a series of field trips to plants in Portland.

Seton Hall University. The chapter saw films at a recent meeting, dealing with the development of the advertising industry and the development of credit in industry.

Syracuse University. The chapter toured the Nestle Chocolate Company at Fulton, N. Y. The chapter viewed a film on the manufacture of newsprint.

Tulane University. The Kaiser Aluminum plant at Chalmette, La., was visited by the chapter.

Temple University. Members of the chapter appeared on WFIL-TV as part of a discussion on "The Use of Visual Aids." A visit to the F. J. Stokes Machine Company was made by the chapter. A successful Student-Alumni dinner was held. The principal speaker at this dinner was Dr. L. A. Drake, Economist, Greater Philadelphia Chamber of Commerce.

University of Baltimore. Mr. Richard Garson, President of the local sponsoring SAM chapter, spoke to the student chapter.

University of Illinois. W. C. Robb, Dean, Job Placement, University of Illinois, spoke before the chapter on "Training Programs for You." The chapter saw a film produced by the General Motors Corporation.

University of Minnesota. Dr. Gerald Nadler, Washington University, St. Louis, Mo., talked to the chapter on "Keeping Abreast of the Times."

University of Pennsylvania. A panel of the Wharton School faculty, including Dr. R. P. Brecht, Mr. W. B. Murphy and Dr. G. J. Anyon, discussed the new book *How to Succeed In Business Without Really Trying.*

University of Richmond. Mr. Starke Farley, of the Richmond Engineering Company, spoke before the chapter on "SAM—What It Is—What It Does."

University of Wisconsin. The chapter heard Mr. Andy Wolff, of the Oscar Mayer Company, speak on "Management Training." The members have toured a number of Wisconsin manufacturing plants including Nash Motors, Allen Bradley Co. and Blatz Brewery. ★

MAY CHAPTER ACTIVITIES*

CHAPTER	SUBJECT	SPEAKER	TITLE	PLACE	DATE
Allentown	Annual General Meeting Social Get-Together and Election of Officers			White Farm Inn	12
	Design of Incentives	W. C. Zinck		Rm. 262, Packard Lab., Lehigh U.	25
Asheville	Southeastern Regional S.A.M. Conference			Battery Park Hotel	7 & 8
	Cooperation with Colleges	E. L. Lynn	Plant Manager, Ecusta Paper Corp.	George Vanderbilt Hotel	14
	Development of Key Personnel	L. F. Zerfoss	Staff Asst. to the Dir., General Industrial Rel., American Enka Corp.	Battery Park Hotel	26
Atlanta	Southeastern Regional S.A.M. Conference			Battery Park Hotel, Asheville, N. C.	7 & 8
Baltimore	Incentives (Harvard Case Studies)	William H. Kirby, Jr.		Gunther Brewing Co. Rathskeller, S. Conkling St.	—
Birmingham	Southeastern Regional S.A.M. Conference			Battery Park Hotel Asheville, N. C.	7 & 8
Boston	Some New Applications of Work Simplification	Dr. Lillian Gilbreth	President and Treasurer, Gilbreth, Inc.	University Club	7
Bridgeport	Recent Trends and Developments in Labor Relations			Hotel Barnum	12
Central Pa.	Responsibility for Safety	A. E. Diem	V. P., Dictaphone Corp.	Camp Hate-To-Leave It, Bellefonte, Pa.	21
Charlotte	Southeastern Regional S.A.M. Conference			Battery Park Hotel Asheville, N. C.	7 & 8
	Facing Today's Personnel Problems	Prof. Richard P. Calhoun	U. of North Carolina	The Barringer Hotel	19
Chicago	Industrial Engineering Headaches				12
Cincinnati	Summary Chapter Meeting			Hotel Alms	7
Detroit	New Horizons for Management	H. B. Maynard	President, Methods Engineering Council		5
Greensboro	Southeastern Regional S.A.M. Conference			Battery Park Hotel Asheville, N. C.	7 & 8
	Ladies Night			Starmount Country Club	22
Greenville	Southeastern Regional S.A.M. Conference			Battery Park Hotel Asheville, N. C.	7 & 8
Hartford	Heart in the Home (Plant Visitation)	Doris Chandler	Connecticut Heart Assoc.	Royal Typewriter Co.	21
Hudson Valley	Production Planning and Control for Job Shop and Process Industries	J. B. McNaughton	Chief Industrial Engineer, Jeffrey Manufacturing Co.	Hendrick Hudson Hotel, Troy, N. Y.	5
Manchester	Current Trends in Relocation of Textile Manufacturing	Prof. Seymour E. Harris	Harvard University Graduate School of Public Administration	Carpenter Hotel	6
Milwaukee	Teamwork for Higher Productivity			E.S.M. Building, 3112 W. Highland Ave.	14
Montreal	Annual Business Meeting			Blue Room, Ritz Carlton Hotel	13
New York	Evaluating Management Development			Hotel Statler	21
N. New Jersey	Annual Business Meeting			Hotel Essex	14

	Labor Relations	John Long	Asst. to the President, Simonds	Poor Richard Club	5

Philadelphia	Labor Relations	John Long	Asst. to the President, Simonds Saw & Steel Co.	Poor Richard Club	5
Pittsburgh	Scientific Management Demands Financial Facts	Dundas Peacock	Controller, Elliott Co.	Hotel Webster Hall	21
Richmond	The Application of Time Study and Methods to Planning, Scheduling & Inventory Control	Steven L. Palmert	Chief, Industrial Eng., Whirlpool Corp.	Hotel William Byrd	26
Trenton	Problems the Industrial Relations Department Faces in Today's Industry	Frederick T. Vansant	Personnel Relations Supervisor, New Jersey Bell Telephone Co.	Hotel Hildebrecht	19
Washington	Government & Business Relations in International Trade Round Table	Alden W. Boyd	Dep. Dir. of Admin., Mutual Security Agency	Federal Personnel Council, 1626 K Street, NW	4
		Karl Anderson	Dep. Dir., Office of International Trade, Department of Commerce		
	Property Management Activities Round Table	Gustave A. Moe	Director, Supply Management Div., FSS	National Archives, Rm. 105, Bet. 7th & 9th Sts., NW, on Constitution Ave.	5
		D. C. Downs	Manager, Government Division, Stern Office Furniture Co.		
	Employee Contributions to Management Improvement Round Table	John E. Moore	Director of Personnel, Dept. of Defense (Office of Secretary of Defense)	Federal Personnel Council, 1626 K Street, NW	7
		Harry Schwartz	Personnel Director, The Hecht Co.		
	Scientific Management in the Home Round Table	R. K. Friedman	Head, Admin. Methods Branch, Dept. of Defense (Navy)	Dept. Aud., Conf. Rm. A, Bet. 12th and 14th Sts., NW, on Constitution Ave.	14
		Catherine Morhard			
	Financial Management Round Table	Karney A. Brasfield	Asst. Chief, Accounting Systems Div., General Accounting Office	Dept. Aud., Conf. Rm. B, Bet. 12th and 14th Sts., NW, on Constitution Ave.	19
		Robert E. Harvey	V. P. and Comptroller, Capital Transit Co.		
	Organization & Management Methods in Government and Business Round Table	John J. Corson	Manager, Washington Office, McKinsey & Co.	Federal Personnel Council, 1626 K Street, NW	19
		Ross S. Shearer	Asst. Administrator (Operations), Economic Stabilization Agency		
	Dinner Meeting			Barker Hall, YWCA, 1649 K Street, NW	21
	Legal Aspects of Management Round Table	John Alexander	General Counsel, National Production Authority	Dept. Aud., Conf. Rm. B, Bet. 12th and 14th Sts., NW, on Constitution Ave.	26
		Peter Nehemkis	Attorney		
	Government-Business Relations Round Table	G. Lyle Belsley	Asst. Adm. for Industry, Adv. Com., National Production Authority	Federal Personnel Council, 1626 K Street, NW	26
		Donald G. Shook	Rep. Dir., Printing and Publishing Div., National Production Authority		
	Management of Scientific Research Round Table	Ivan Asay	Chief, Planning Staff, National Bureau of Standards	Federal Personnel Council, 1626 K Street, NW	28
		Allen H. Schooley	Assoc. Supt., Radio Div. III, Dept. of Defense (Navy)		
Wilkes-Barre	Cost Control Through Flexible Budgets	D. A. Smith	Mgr., Finance, General Electric Co.	The Stines, Butler Valley on Rt. 309 to Hazelton	4
Wilmington	Case Study in Complete Application of Management Techniques	Ralph Gery	Manager of Industrial Engineering, Eli Lilly Co.	Hob Tea Room, Delaware Trust Bldg.	5
Worcester		Milton P. Higgins	President, Norton Co.	Worcester Country Club	11

*This is a summary of the Chapter activities reported. Programs of the other 29 will be listed upon receipt.